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# A JOURNEY TO THE YEMEN

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THIS lecture is the story of the British Museum (Natural History) Expedition to south-western Arabia, from August 1937 till March 1938. The area under review is the extreme south-western corner of the Arabian peninsula, that is, the western division of the Aden Protectorate and, north of it, the Yemen; a corner not touched by the accounts recently given to the Society, either of the Land of Sheba, lying immediately north and east, or of the Hadhramaut.

The expedition originated in a desire to compare the fauna and flora, and above all the insects, of the south-west Arabian highlands with those of the Abyssinian highlands across the Red Sea. In 1926–27 I had carried out a six months' journey in south-central Abyssinia. In 1935 a projected second Abyssinian expedition, intended to visit the north Abyssinian mountains, was frustrated by the outbreak of war. I then turned my attention to south-western Arabia, where there are high plateaux and mountain ranges comparatively recently separated, geologically, from those of Ethiopia and Eritrea. Comparisons have been made between the plants and the larger animals of these two blocks of highlands, in which tropical African fauna and flora meet and overlap with northern and, to a less extent, with Oriental forms. There are indications that these highlands have served as stepping-stones in the dispersal of certain organisms characteristic of these three great regions. But in investigating the insects, and invertebrate animals generally, we were on almost virgin ground. What light they will throw on the bio-geographical problems involved will be seen when the many thousands of specimens are studied by experts. At present I am concerned less with our scientific work than with the country itself, its people, and our personal experiences. Some brief allusions to the history and ancient culture of the land are also included to make the narrative intelligible.

I travelled to Aden with Mr. Everard B. Britton, a colleague in the Department of Entomology at the British Museum. To his great enthusiasm and

industry the extent of our collections is very largely due. From Aden onwards our party included three Somalis, who were engaged during our first days at Aden and stayed with us throughout the whole expedition. Besides acting as servants and interpreters these men became very keen and efficient collectors, and their willingness and lively sense of humour contributed greatly to our success. Further, we gladly acknowledge here how much we owe to the friendly disposition of the country people, particularly the tribal guards and soldiers provided by the several Arab rulers and governors in whose territories we worked.

The deserts of Arabia were not our concern. We only crossed the narrow coastal belts of desert and semi-desert country known as the Tihama to reach our objective, the high plateaux and mountains where the maximum of summer rains produces the greatest degree of fertility. We timed our visit to reach the highlands before the end of the summer rains and reap the benefit of the period immediately after, which my previous experience in Abyssinia had shown to be so rich a time for collecting. My narrative and photographs will show how far these highlands of the old Arabia Felix are removed from desert conditions. Though purely geographical discoveries cannot be claimed, we travelled over country in the highlands of central Yemen, at altitudes often over 9000 and sometimes up to 10,000 feet, known to very few Europeans and to only a handful of living British. The northernmost point reached was about 17 miles north of San'a and over 200 miles north of Aden.

*The western Aden Protectorate*

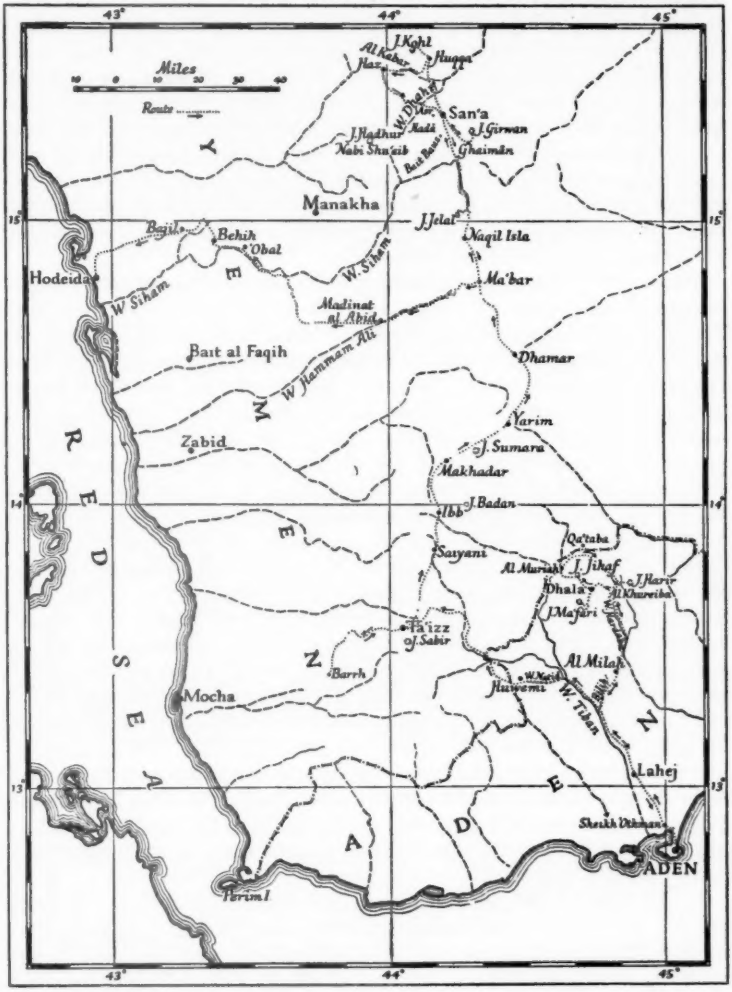
The Yemen is a closed country, into which Europeans can enter only with the express permission of its ruler, and some time elapsed before the necessary permission was obtained for us by the Government of Aden. Thus it fell out that we spent more than two months in the interior of the Protectorate, returned to Aden and set out afresh by a different route, before crossing the Yemen frontier. This calls for no regret, for the highlands of the western division of the Protectorate yielded a very important part of our collections. These highlands and their people have much in common with those of the southern Yemen, and merit some description.

The area chosen was the Amiri country round Dhala, a town of several thousand inhabitants and the centre of an hereditary Amirate. Dhala, about 65 miles north of Aden, lies 4800 feet above sea-level, and the surrounding country, notably the great massif of Jebel Jihaf, offered chances of camping and working at points well over 7000 feet. Moreover the Amirs of Dhala, father and son, ever show themselves most friendly to British visitors, and we owe much to the kindness of these rulers, Amir Nasr ibn Shaif and his son, Amir Haidara.

After a week spent in Aden, busily engaged in preparations at one of the hottest periods of the summer, when the temperature in houses was sometimes close on 100° F. and water drawn from cold taps reached that point, we started for Dhala on September 10. Our convoy consisted of a small car and a lorry packed with our tents, apparatus, and stores. We hoped to make the journey, over 90 miles by car, in the day, but actually it occupied two.

I can only touch briefly on the route. From our starting-point at Khor-

maksar, on the narrow flat neck connecting the peninsula of Aden with the mainland, a metalled road leads to the settlement of Sheikh 'Othman, 10 miles from Aden and the limit of the colony proper. North of this, police posts and




*Part of Aden Protectorate and Yemen, showing the author's route*

up-swinging barriers mark the entrance to the Sultanate of Lahej. A track over sandy desert leads to the town of Lahej, the Abdali Sultan's capital, about 27 miles north of Aden. Large and lofty buildings, the more modern in a rather nondescript style, the older more typically Arab, are the residences of

the Sultan and his family; these contrast with the *suqs* and humbler dwellings of the populace.

North of Lahej a pleasant stretch of road runs through fertile irrigated fields of *dhurra* (millet), between the two branches of Wadi Tiban. At Al Huseini, on luxuriant estates belonging to members of the ruling house, many products of the eastern tropics are cultivated. The road is bordered by broad-leaved *Terminalia* trees, beyond which lie large plantations of bananas edged with rows of pawpaw trees. Besides numerous date palms, here are large mango trees, young coconut palms, custard apples, pomegranates, citrus, sugar cane, roses, and cannas. Two months later we spent nearly a week at this spot, camping in an empty country house belonging to a brother of the Sultan, and profiting in our search for insects from the wealth of flowers, wild and cultivated; surrounded also by the varied bird-life of the oasis, green bee-eaters, white egrets, white storks and black storks.

After another short sandy stretch we were among stony foothills sparsely dotted with scrub. Along the tributary Wadi Bilih the track leads from Wadi Tiban over the watershed into the broad Wadi Milah, encircled by rocky mountains. Repairs to the engine of the lorry necessitated passing the afternoon and night at Al Milah, which boasts only very few mud and stone-built houses (at one of which we slept), and where most of the dwellings are low huts constructed of brushwood—a village still characteristic of the lowlands. How far we could have gone in any case is doubtful, for the rain-clouds gathered over the mountains inland, and a spate of water came down the wadis. We had a further reminder of such happenings next day, when we passed a derelict car abandoned through damage caused by a sudden flood.

Much of the second day's journey lay along the sandy and boulder-strewn bed of Wadi Hardaba, between rocky mountains of increasing height. Running water tempted us to stop several times and collect moisture-loving insects. African butterflies flitted among the tamarisks and other scrub fringing the wadi, and large hornbills (*Lophoceros nasutus forskalii*) flew in groups from tree to tree. But this time the small car developed engine trouble and had to be left in the upper part of Wadi Hardaba, while we finished the journey in the lorry. From the head of the wadi we ascended to the Dhala plateau by the winding rocky defiles of Al Khureiba pass, up the paved road constructed by the British during the period 1904–07, when the frontier of the Protectorate and Turkish Yemen (as it then was) was being fixed. Our journey to Dhala thus occupied thirty-five hours, but two months later we made the return journey to Aden in five hours.

On the rolling Dhala plateau in mid-September almost every cultivable spot was covered with tall green crops of ripening *dhurra*. Low rocky hills rise from the general level, dotted with drought-resisting succulent plants, especially dwarf cactus-like euphorbias, of which we were later to see more varied, and often taller, forms. Some rather higher hills are topped by crowded villages, while the whole plateau is surrounded by mountains rising to altitudes between 6000 and nearly 8000 feet, coloured in varying shades of tawny and darker brown and greyish-green, according to the nature of the rock and the prevalence of scrub vegetation.

The countryside holds surprisingly luxuriant spots, narrow clefts and

*Dhala: principal mosque, part of town, and castle*

*View north-east from summit of Jebel Jihaf, showing terraced cultivation of dhurra*

*Jebel Jihaf: village mosque with tree-euphorbias and houses to the right*

*Waterfall in Wadi Dareija*

*Threshing wheat on Jebel Jihaf*

*The head of the lower gorge in Wadi Leje*

gorges where the cliffs give shade during part of the day and where perennially running water favours rank vegetation and the growth of large trees. Such is Wadi Dareija, a few miles south-west of Dhala, on the old track still used by camel caravans to and from Aden. It is approached through a wood of old spreading *'ilb* trees (*Zizyphus*), recalling olives, until closer inspection reveals their thorns and little cherry-like fruits. Beyond this wood is a gorge, the cliffs of which are the abode of troops of baboons. It is divided by a sudden drop, and the lower gorge is reached by a zigzagging path, beside a cliff of calcareous rock, the bottom of which overhangs shallow caverns filled with stalactitic formations. To one side is a narrow recess, where a waterfall tumbles into a pool shaded by large wild fig trees, the roots of which wind serpent-like along the cliff-face and penetrate the joints of the rock. A tangle of bushes and other vegetation surrounds the pool and extends along the talus slopes of the lower gorge.

The unwalled town of Dhala lies at the foot of a crag crowned by the Amir's castle. Here and in the neighbouring villages the houses are massive and tower-like, two or three storeys high and with walls sloping slightly inwards. They are built of large blocks of dark igneous rock, with doors and windows picked out in whitewash. The ground-floor is given up to storerooms and the stalls of domestic animals, and a visitor must grope his way up a staircase with many turnings, often pitch-dark, to the much lighter and more airy living-rooms at the top. Some houses display, outside, ornamental stringcourses and round-headed recessed arches having some resemblance, superficially at least, to Norman architecture. But here is none of the very elaborate house decoration seen in the cities of the Yemen; otherwise we met with houses of the same type, though varying locally in materials, throughout most of our journey.

The mosques at Dhala are also rather rough and simple buildings with little ornament; while those in the hill villages are small low quadrangular structures, flat-roofed and with a rough pinnacle at each corner, without minarets and with a plain walled outer enclosure.

On September 16 we left Dhala and camped on Jebel Jihaf at 7100 feet. Our kit was carried up on camels and donkeys, and we followed on horses lent by the Amir. The 7 miles of mountain track present no difficulty beyond some very steep glacis of bare rock near the top. Later we used to ride up or down in about two and a half hours, as against the one and a half hours which the younger Amir, Haidara, allowed himself. The Amir's smaller mountain castle (as distinct from the castle at Dhala) is perched on a very steep conical eminence, at the base of which Amir Haidara met us on horseback, with sixteen tribal guards on foot, and conducted us up and into the castle. After being very hospitably received we descended the far side of the castle hill and pitched camp on level ground, partly a disused cemetery, none too soon, for about four o'clock a torrential rainstorm broke.

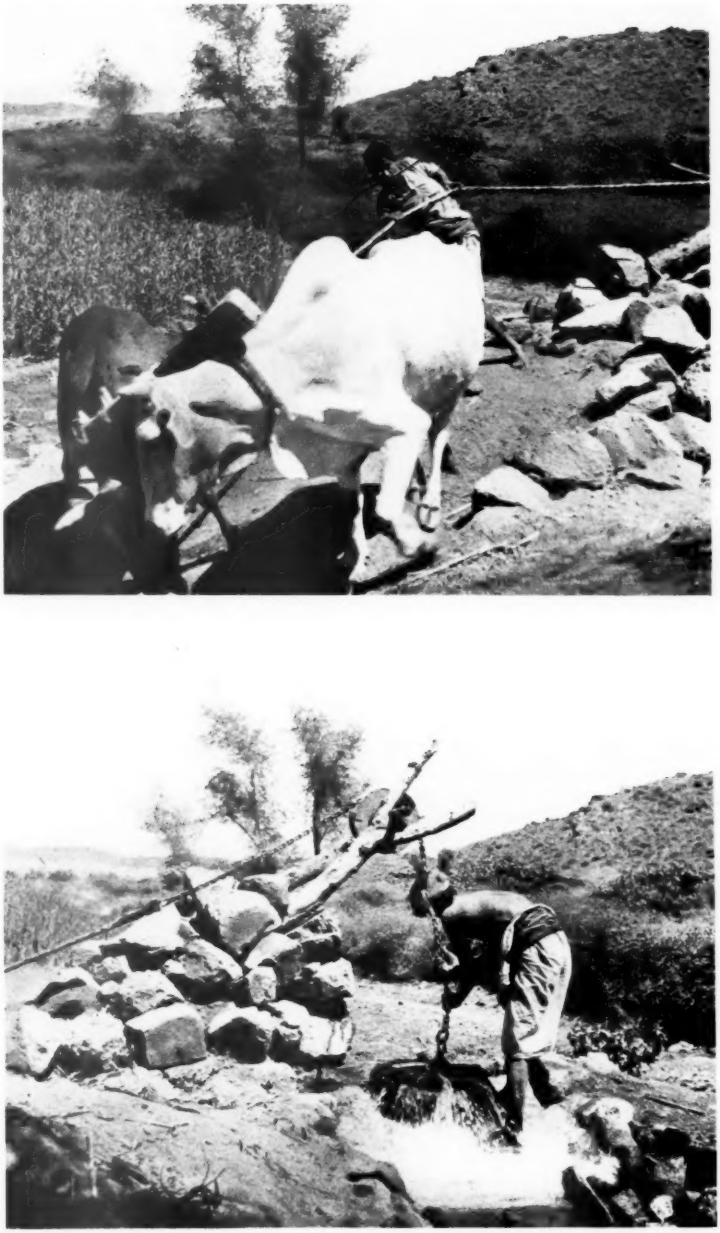
Jebel Jihaf, a fine mountain when seen from the south-east at Dhala, is even grander when viewed, as we afterwards saw it, from the north-west, where its precipitous walls rise some 3000 feet from Wadi Tiban. It is less a single mountain than a great massif of igneous rock extending about 15 miles from south-west to north-east. Much of the top is occupied by a bowl-like

plateau, girdled with rocky hills, one of which, to the north-east, is the highest point (7800 feet). The plateau is closely cultivated, and stone-terraced fields are carried up the slopes in every possible place, while numerous small villages cling to rocky eminences and hillsides. From the actual summit a chasm winds down the north-eastern extremity of the mountain, with terrace upon terrace of tall green *dhurra* stretching up the almost precipitous sides for 1000 feet or more, and clusters of tower-like houses crowning point after point of the jagged ridges.

Every place impossible of cultivation is covered with sharp-edged blocks of rock, dotted with fleshy euphorbias, wiry and prickly bushes, herbs, and patches of grass. At this season flowers and insects were there in profusion, but the prevalence of thorns and sharp stones made the ground difficult enough to work on. The least sun-scorched and moistest spots, on the precipitous north-western faces, near the summit, shelter real mountain plants, including a creeping campanula (probably *C. edulis*) and a pretty gentianaceous rock plant (*Swertia polynectaria*). In less shaded places grows an almost stalkless rock pink (*Dianthus uniflorus*), which we afterwards found at many points in our journey between altitudes of 8000 and 9000 feet. Among the more ordinary plants in waste places were prickly acanthaceous bushes of the genus *Barleria*, with showy trumpet-shaped flowers, in one species lilac shading to a deep purple centre, in another (*B. trispinosa*) almost peach-coloured; a low-growing hibiscus (*H. meidiensis*) with scarlet blossoms, a fleshy-leaved *Calanchoe* with heads of orange-yellow flowers, and a bush *Senecio* which, sprawling over other plants, attains a height of about 8 feet. The two last were not in bloom till some weeks after the ending of the rains.

Wadi Leje, an extraordinary winding cleft in the south-western part of the mountain, is so deep and narrow as to be in shade during much of the day. In the upper part a stream descends by a succession of small waterfalls, where maidenhair fern and groups of tall yellow primulas (*P. verticillata*) grow at the water's edge. Farther down the wadi narrows to a gorge about 20 feet wide, with nearly vertical cliffs, and progress is stopped by a sheer drop of several hundred feet in the floor. Members of our party, lowered over this with a rope, only succeeded in reaching an otherwise inaccessible rock-ledge. To gain the lower and broader part of the valley on another day involved a long detour ending in the descent of some 800 feet of steep rough talus, dotted with little silvery-leaved bushes with blue trumpet-shaped flowers (*Barleria Hildebrandtii*). But the head of the lower valley, at about 5600 feet, was luxuriant, with a cascade pouring down a cliff; evidently a favourite haunt of sunbirds (*Cinnyris habessinicus hellmayri*), the brilliant iridescent plumage of which flashed as they darted among flowering bushes.

At the end of September the tribesmen of Jebel Jihaf were busy with *dhurra* harvest. Gangs of labourers, stripped to the waist, wearing white skirts to the knees and white or indigo-dyed turbans, hand-picked the heads of grain from the tall *dhurra* plants. All day the countryside resounded with a chorus, haunting and drawn out into quavering notes, sung by the harvesters. Wheat and barley were also reaped and laid out in small bundles on natural threshing-floors of bare rock. Threshing is done with an unjointed flail consisting of a long curved stick, and winnowing by the simple process of holding



*Drawing water from a well at Dhala: humped oxen descending an inclined plane, and water being directed from a hide bucket into a channel*

*View from the eastern edge of the top of Jebel Harir, 7700 feet*

*Ta'izz, looking north from guest-house; pawpaw trees in front of mosque*

a petrol tin or other receptacle over the head and pouring the grain and chaff out slowly, so that the chaff is blown away. After the *dhurra* heads are gathered the stems are grubbed up and piled in conical stacks for fodder and litter. Ploughing with yoked oxen then begins, and the ploughman's womenfolk often follow in his wake, breaking the clods with mattocks. Water is drawn from the numberless wells (Jebel Jihaf alone is said to have several hundred) all through the day for drinking and for the irrigation of beds of young onions and other crops; a yoke of oxen, descending an inclined plane, hauls up a large leather bucket by a rope passing over a wooden pulley.

All these were normal agricultural occupations. But we were also privileged to see the first agricultural show ever held in the Aden Protectorate, a venture which we hope will be repeated. This took place at Dhala on September 24, as part of the events marking a visit of the Governor, and it was accompanied by a parade of the Amir's army and by games and sports; also by a great gathering of tribesmen, by irregular tribal guards discharging their rifles into the air, and by tribal dances held at night in the light of bonfires.

On October 19 we left Jebel Jihaf and camped close to Al Muriah in Wadi Tiban, descending from the brink of the great mountain wall, which had bounded the area of our work for a month, more than 3000 feet into the vast and wide chasm beyond which rose the brown ramparts of the forbidden Yemen highlands. The caravan track down the precipitous north-western face of the mountain is an extremely steep zigzag, with towering cliffs on either hand. It was successfully negotiated by the eleven camels, four donkeys, and ten porters carrying our collections, camp outfit, and stores; but the Amir's riding-horses refused to carry us down, and we descended on foot. (No mules are forthcoming in this district, though in the Yemen highlands to the north they are largely used for riding and pack transport.) Delays in striking camp and loading the camels on Jebel Jihaf resulted in our not reaching the foot of the precipice till dusk, but with a quick scampering ride over the lower spurs and foothills, dodging in and out of thorny acacia scrub, fortunately in the light of the full moon, we arrived at a village, where we spent the night.

Al Muriah formed an unpleasant contrast to Jebel Jihaf. Instead of the exhilarating climate of the mountain top—where minimum night temperatures ranged between 57° and 51° F., though the day maximum in our tents was sometimes nearly 90°—we experienced greater heat and a strong dust-laden wind from the south-east. The immediate surroundings were grim and stony rolling hummocks, sparsely dotted with low trees and bushes, now almost leafless. Here and there grew the monstrous-shaped swollen-stemmed tree *Adenium*, about 4 to 8 feet high, without leaves but covered with handsome crimson flowers. Despite the generally parched conditions we did not escape the attentions of malarial mosquitoes, visitors from one of the moister hollows, the floors of which are the only cultivable places and contain patches of rank green scrub. Malaria is prevalent, and the local tribesmen look less healthy than those of the mountains. Their houses also are low and rather wretched-looking, but the village of Al Muriah is graced by a little domed whitewashed mosque, a very conspicuous object, standing a short way off. It contains the tomb of one Weli Isma'il, a saint of local fame, and is the scene of local pilgrimages.

Al Muriah is close to the Tiban river, which lies in a valley bounded by cliffs. The Tiban in late October was running, swift and shallow, over a stony bed; its banks are fringed with tussocks of long grass, dwarf date palms, tamarisk, and other vegetation. As a collecting ground it was productive, but we failed to rediscover the African tsetse fly, *Glossina tachinoides*, recorded (the only species outside Africa) from this and other places in the south-western part of the Protectorate more than thirty years earlier.

On October 23 we moved to the foot of Jebel Harir. Though this lies only some 10 miles from Dhala, north of east, the journey from Al Muriah was over 20 miles, along the great wadi, round the eastern end of Jebel Jihaf, and up a narrow valley into the eastern mountains. In the gap between Jihaf and these eastern ramparts the barren stony ground of Wadi Tiban gave place to a much pleasanter landscape of fertile *dhurra* fields, newly ploughed, dotted with large spreading *'ilb* trees. Delays, such as the bolting and reloading of a camel, with noisy argument between tribal guards and camel-men, retarded our start, so that we were again benighted and finished the journey in darkness, unhelped by the moon. But riding-donkeys carried us safely over broken ground, up and down the sides of steep rocky gullies torn in the mountain spurs, and through thorny scrub, long after it was too dark for us to distinguish objects. We slept on the roof of a solitary house, belonging to a peasant, at the mountain foot, with a cow bumping its back against the ceiling of the low room beneath us. The baggage train arrived late, but we availed ourselves of waterproof ground-sheets to cover our bedding against a chill drizzle, the first rain for weeks.

Jebel Harir, a mass mainly of sandstone, not igneous rock, is very different from Jebel Jihaf. The sides are extremely steep, while the top is a wide sloping expanse of bare rock. Loaded pack-animals cannot ascend the exceedingly rough tracks, which cross bare rock-glacis at a sharp angle. In spite of this, the top of Harir, between 7000 and 7790 feet above sea-level, supports a large human population. There is ample water (we found a large pond fringed with ferns and willow-herb in a rock cleft), the scanty soil is piled up into little fields supported by stone walls, and there are several good-sized villages of tall stone houses.

We decided, owing to the difficulties of transport, to camp at the bottom, and for a fortnight worked on the slopes and in deep narrow wadis radiating from the mountain foot, in which there was running water and plenty of vegetation. Twice we climbed nearly 2000 feet, from our camp at 5200 feet, to the western edge of the top, then traversed the upward-sloping rock plateau till the summit, about 600 feet higher, and crowned by the rather elaborate tomb-mosque of a saint, was reached on the eastern edge. Thence from the brink of a mighty precipice extends an unforgettable view of a chaotic jumble of jagged mountain ridges, over the Halmin country towards Upper Yafa; country we could hardly have entered had we wished, for Jebel Harir is on the fringe of the jurisdiction of the Amir of Dhala, and the tribes beyond have as yet an uncertain reputation. The four tribal guards, who had been with us six weeks, were nightly reinforced by an additional guard of ten men, supplied under the Amir's orders by the *'aqils* (head men) of the villages of Jebel Harir in rotation. One night two parties arrived, and a noisy dispute

between them ensued. But we remained unmolested, returned to Dhala for our last few days, and thence on November 10 to Aden.

*The Yemen*

Permission to enter the Yemen was withheld till some time after our return to Aden, when the Government received the Imam's consent to our visiting Ta'izz, the principal city of the south. The invitation to visit the capital, San'a, only reached us after we had been some days in Ta'izz.

The Yemen is still little known, and some description of it is necessary in order to render the remaining narrative intelligible. Literally the country "on the right hand," it is, as at present defined, a State lying between lat. 12° and about lat. 18° N. Its greatest length, from Sheikh Sa'id, on the Red Sea coast opposite to Perim Island, to the southern borders of 'Asir in Sa'udi Arabia, is somewhat over 300 miles; its area is estimated at approximately 74,000 square miles (nearly five-eighths that of Great Britain) and its population at from three and a half to over four millions. Its ruler holds a very ancient office as Imam, or spiritual head, of the Zaidi sect of Shi'ah Moslems, whose main stronghold is in the high plateaux and mountainous districts about San'a. But he has also, since the withdrawal of the Turks after the Great War, become temporal sovereign of the whole country, including the orthodox Sunnis of the Shafa'i school in the southern districts, the tribesmen of the Tihama, or coastal desert, and other tribes and sects. Over these heterogeneous elements the Imam holds absolute sway. However backward the country is in some respects, a high degree of internal peace and order has been effected under the present regime.

The Yemen was however the centre of a very ancient civilization, which extended far beyond the frontiers of the present State. A few lines on this subject are necessary, because our work took us to certain sites of the ancient culture, and some of the oldest cities served as our bases. I can barely mention the Minaean, Sabaean, and Himyaritic civilizations, the last so named from Himyar, the great-grandson of Kahtan, who is traditionally identified with Joktan, mentioned in the tenth chapter of Genesis as a great-great-grandson of Shem. At Huqqa, north of San'a, where are the remains of a sun temple, and elsewhere round the capital, many sculptured and inscribed stones of this period are built into the walls of Arab houses. Such stones, finely worked and of fine-grained limestone brought from some distance north, are conspicuous from a distance, as their whiteness contrasts with the rough blocks of dark igneous or other rock, quarried locally, used in the later buildings. The best of the pre-Islamic objects as yet discovered form the nucleus of a museum in a government building at San'a.

Judaism found its way into the country during the latter part of the Himyaritic period, and a Himyaritic king is said to have adopted this religion about the fifth century A.D. (see p. 119). To this day there is a large population of Yemen Jews. Christianity also was introduced, apparently late in the third or in the fourth century, and was forcibly spread by the Abyssinians, after their invasion and final overthrow of the Himyaritic dynasty early in the sixth century. We read of Nejran as a stronghold of Christianity, with a bishop. But no traces of ancient Christianity are obvious; the only Christians in the

Yemen now are Europeans, and no public Christian worship is allowed. The Abyssinian domination ended late in the sixth century with the Persian invasion, and the Persian rule itself gave way before the Muhammadan conquest.[1]

Among the later vicissitudes of the Yemen is the rise of the Zaidi sect, named from Zaid, descendant of 'Ali, son-in-law of the Prophet. As to the peculiar tenets of this body, it need only be recalled that they differ from other Shi'ahs in their conception of the grounds on which 'Ali secured the office of Caliph. But the Zaidi form of Islam has expressed itself in many customs, and architectural and artistic forms, still living and active, remarkably different from those of other parts of Arabia.

The head of the Zaidi sect has been styled "Imam" since the days of one Al Hadi Yahya, the eighth generation from Fatima and 'Ali (Muhammad's daughter and son-in-law). Thus, from the beginning of the tenth century A.D., subject to the temporary submergences incident to Oriental dynasties, Imam has followed Imam; the earlier Imams resided at the northern city, Sa'da, the later ones at the present capital, San'a. The Imamate has not hitherto been necessarily a directly hereditary office, though its holder has been chosen from a ruling house of Saiyids (descendants of Muhammad through 'Ali's son Husein). The candidate must further conform to several other requirements, among them freedom from any physical blemish.

The Yemen was a Turkish province, with a Turkish Pasha as governor-general in San'a, from about A.D. 1538 to 1630, and again from 1872 till 1918. The latter period of Turkish dominion has left its mark in the shape of certain large government buildings at San'a and elsewhere, while some officers formerly in the Turkish army, and other Turks, are met with at the capital.

We left Aden on December 8. On the 130-mile journey to Ta'izz, by car and lorry, we took our tents, meaning to visit on the way the hot sulphurous spring at Huwemi, still within the borders of the Protectorate. After this, and once within the Yemen, our route was strictly marked out for us, and we were lodged everywhere in government guest-houses, or in other houses by arrangement with the Government.

To investigate Huwemi we camped two nights at Kirsh, on a bare rocky eminence amid a wild, lonely landscape surrounded by rugged mountains. Almost the only building in sight was a small military post of the Sultan of Lahej, whence a guard for our camp was provided. At Huwemi itself, a few miles away, the hot spring wells out on a slope of short turf, in a broad glade surrounded by thickets, varied with some cultivated fields and a few date palms (the altitude is about 2200 feet). The temperature of the water at the source was 152° F., and it appeared devoid of life; but 100 yards or so down the stream aquatic insects were found in water at 120° F., and others in a large pond at 94° F. The whole locality proved a rich collecting-ground.

On December 10 we passed the frontier barrier of the Yemen in a grim and narrow part of the Wadi Natid. A rough stone frontier tower stands on the

[1] Authority for the statements in these paragraphs will be found in the works cited in the note on p. 121; the early chapters of Harris's 'A journey through the Yemen' contain an admirable historical summary.

*Ibb: southern gate from outside the city*

*Menzil Sumara (right foreground) from the pass at 9200 feet*

*Descending from the Sumara pass to the plateau of Yarim*

*Ancient cemented cistern south of Dhamar*

*Craters and lava-flows north of Jebel Kohl*

slope to the left. We ascended to plateaux and rolling hilly country, crossed a fair-sized river, and at length came in sight of Ta'izz, lying at the foot of the huge mass of Jebel Sabir.

Ta'izz, the most beautiful city in the Yemen, our headquarters for nearly three weeks, lies at 4500 feet above sea-level, on the lowest spurs of the northern slope of the great mountain which rises to 9800 feet. Ancient walls encircle the city on three sides, running at either end up the slopes of the mountain, which forms a rampart to the city on the south. A very steep detached crag, capped by the citadel, dominates the town, which can be entered by two gates, one at either end of the north wall. The tall white minarets of several large mosques rise above the other buildings. These mosques differ architecturally from those in the Aden Protectorate and from those of Ibb, Yarim, and San'a. Their minarets, especially, are characteristic, the upper stages being polygonal and decorated with series of arched recesses. In this city we became familiar with the great houses of three and four storeys, with traceried upper windows, which, with local variations, are typical of the large cities, for we lived in the elaborately decorated upper rooms of a large new guest-house near the centre of the town, built by the 'Amil (the governor of the city).

Ta'izz is less prosperous than formerly, with a population estimated at only a few thousand and much empty space within the walls. The old mosques show signs of disrepair, and the smaller shrines and tomb-mosques, though beautiful, are often dilapidated. Patches of refreshing verdure among the buildings are formed by gardens of banana, pawpaw, and other trees, which flourish despite the cool nights (we recorded a minimum of 54° F. on December 14). Streams in great number, descending from Jebel Sabir, run in and near the city; the water is jealously conserved, conducted through cemented channels and stored in wayside tanks, often of ancient construction. Unfortunately the district is malarious. In December the risk is slight; we saw very few mosquitoes at all and no anophelines. But we scarcely relaxed our precautions, and it was unlucky that my companion, bitten by some unperceived anopheline, contracted malaria, which developed on the way to San'a.

The present city of Ta'izz is at least several centuries old. On the north slope of Jebel Sabir, eastwards, stand the ruins of an older walled city, which we were not allowed to examine closely, spoken of simply as "Old Ta'izz."

Every cultivable part of Jebel Sabir is terraced and given up to the growing of *qat* (*Catha edulis*), a tree believed to have been originally introduced from Abyssinia. The practice of chewing its leaves is the bane of this part of Arabia. The alkaloid drug contained in the plant has at first a mentally stimulating effect, but later causes various symptoms of debility in the addicts, while at the height of a bout the symptoms may resemble those of alcoholic intoxication (see Appendix, p. 121).

The ridges of Jebel Sabir are dotted with round towers and rectangular tower-like houses, and on one spur, 1500 feet above the city, gleams the white residence of the Governor-General of southern Yemen, the Amir of Ta'izz, who divides his time between this upper house, Dar en Nasr, and a lower residence at Al 'Urdi, a mile outside the town. Twice we saw him at his lower house, and twice at the "House of Victory" (Dar en Nasr). We rode up to

the latter by a zigzagging path, on mules, escorted by soldiers uniformed in white skirts reaching to the knee, with turbans and shirts dyed indigo. Such warriors, usually very good-natured, were our constant companions, one or more at a time, on every excursion and journey from now onwards.

The Amir, Saiyid 'Ali ibn al Wazir, a man of great intelligence, was in manner friendly and informal, quickly disposing of the complimentary phrases needed to open an interview. He usually wished to discuss the latest political news received by radio, and wasted little time over our specimens or explanations of our work, which had already been fully set forth to the 'Amil of the city. In restricting our movements, the Amir was only acting on orders from San'a.

The highest parts of Jebel Sabir were forbidden, but we penetrated two steep winding wadis in its northern face. The nearer, Wadi Thabad, visited several times about Christmas, had almost every inch of its slopes covered with an intricate system of terraces planted with *qat* trees and dotted with buildings; but tangles of white wild roses, almost past flowering, trailing clematis, thick with cream-coloured blossoms, and other bushes and trees covered any waste space. The other valley, Wadi Sabir, a wild, lonely place, the only visible inhabitants of which were conies, had steep, rocky, and grass-grown sides which we climbed to above 6000 feet.

Apart from the mountain, the surroundings of Ta'izz consist largely of stony ridges dotted with cactus-like euphorbias, unproductive places for us in December. The cultivated hollows hold some luxuriant spots, such as Usaifira, a mile north of the city. Here an old tower stands beside a great rectangular masonry-walled cistern full of water, partly shaded by large trees; below this are irrigated fields of onions, tomatoes, mustard, and other crops, while the rank vegetation and abundant flowering weeds in every waste place, even in the height of the dry season, teemed with insects, the smallness and obscureness of the majority being relieved by the presence of large handsome dragonflies and butterflies.

Our request to visit San'a, telegraphed by the Amir to the Imam, was at length granted, and, better still, we were allowed to travel by the inland route through the highlands, *via* Ibb, Yarim, and Dhamar. The six days (December 30 to January 4) of the journey are among the most vividly remembered of the whole expedition. From Ta'izz we travelled by motor transport some 22 miles to Saiyani, over rolling country and through extensive areas of succulent bush- and tree-euphorbias of many kinds, varied with aloes on tall pole-like stems. At Saiyani the heavy baggage was transferred to camels, while we rode mules for 10 miles up the Wadi Makhris and over an 8000-foot pass to Ibb. A winding mountain road, well paved with large ancient blocks of stone, leads up the side of a lovely amphitheatre of hills with terraced slopes. Rich vegetation by running streams tempted us to stop, as did tall trees of an African species of buddleia (*B. polystachya*), with heliotrope-scented spikes of orange-yellow blossom, at a small village. Near the top of the pass the bare red earthen sides of gullies torn by streams were dotted with scabious and other flowers, while on the other side of the watershed a stream fringed with buttercups (*Ranunculus multifidus*) and tall yellow potentillas (*P. viscosa*)

made a strip of verdure amid bare earthy slopes. When at length we overlooked a broad valley, our first glimpse of Ibb was of a white city still far distant, perched on a mountain spur and shining in a gleam of evening sunlight penetrating through heavy clouds. Approaching in growing cold and darkness, we were met by servants of the Amir of Ibb, with lanterns.

Ibb, a most remarkable city, stands at an altitude of some 6700 feet, on a westward-projecting spur of Jebel Shemahe, reaching over 8000 feet, behind which is the far higher Jebel Badan. Unlike Ta'izz, Ibb has a very large population, and almost the whole area within the old walls is filled with buildings, lofty houses separated by narrow, twisting lanes, and crowded *suqs*. The mosques are numerous, but many are rather low buildings and few have minarets, so that the city has not the many-towered appearance of San'a. When led through the town and to the aqueduct which brings water from the hills outside the walls to the east, we were so thronged by dense crowds that our askari guard had to force a passage, occasionally charging and laying about them with long reeds or bombarding the populace with clods of earth. In an early call on the Amir, Saiyid Yahya ibn Muhammad, we explained our mission anew, and later saw his ceremonial Friday return from the mosque. Accompanied by other notables, mounted and preceded by a cavalry escort, with drummers and riflemen on foot, he was received at his door by many chief men of the city in full dress, robes, shawls, and turbans of many colours.

On 1 January 1938 we rode by mule about 28 miles to Menzil Sumara, at the foot of the Sumara pass, passing Makhadar about halfway, as we were pressing on to gain the longest possible time for collecting specimens at high altitudes. From Ibb the track descends sharply, then leads over rolling country along a broad valley, among cultivated fields, euphorbia-covered rocky hillocks, and through scrub where groups of golden sparrows (*Auripasser euchlorus*) flitted from tree to tree. We were fortunate in passing Suq as Sabt, about halfway to Makhadar, on the day which its name ("Saturday Market") connotes, and saw this great country market in progress, while numbers of tribesmen were coming and going on the road. Beyond Makhadar we turned right (*i.e.* eastwards) along the dry bed of a beautiful winding valley, fringed with flowering trees and containing orchards and coffee plantations.[1] At its head a stiff climb brought us, just as dark had fallen, to the rough mountain village of Menzil Sumara, where, at 8000 feet, we stayed two nights in the house of the *'aqil*. Much of the authority however rested with his mother, a very ugly old woman named "The Beautiful," who had decorated the whitewashed walls of the room we occupied with primitive designs in an ochreous tint. But the room was low, cramped, and windowless, and we were glad to sleep outside on the flat roof of the lower storey. Next day was spent collecting specimens at the top of the pass at an altitude of 9200 feet, whence magnificent mountain scenery extends in both directions. Close to Menzil Sumara a large patch of wild iris (*I. albicans*) displayed some scented white flowers even at this season;

[1] We had seen a small coffee plantation on Jebel Jihaf at 7000 feet. Apart from this and the plantations mentioned above, we saw few coffee trees. We did not visit Manakha, the centre of cultivation (at about 4000–8000 feet) of the famous coffee which takes its name from the decayed port of Mocha.

roots were planted on the rough graves of the burial ground, a purpose for which other wild plants are also used in village cemeteries.

On January 3 we began the 16-mile ride to Yarim early, to snatch every possible moment for collecting on the high pass. The departure of the baggage train at 4.30 a.m. was proclaimed by the tinkling of camel-bells, while the stars still shone, and we followed on our mules at 6.30, soon after daybreak. When the sun's rays struck over the 10,000-foot mass of Jebel Sumara, on to the path winding eastwards along the shoulders of the mountain beyond the narrow col, they were welcome, for the air, though exhilarating, was very cold.

The highest point on the road is about 9700 feet. Most of the mountain vegetation was dry and seared by frost, but insects and shells were still to be found in crevices, under stones, and beneath tufted plants. Beyond this point the track falls abruptly to a plain at about 9000 feet altitude, a dun-coloured patchwork of bare ploughed fields. From now onwards the great beauty of "the verdant Yemen" was behind us, and we saw nothing rivalling the country we had traversed till two months later, when we left the high Yemen by the luxuriant valleys running westwards towards the Red Sea.

The 'Amil of Yarim gave us hospitality in the great government building, the Hakuma. Being visited that evening by certain men of some education, we asked whether any tradition remained of the death in Yarim in 1763 of Dr. Forskål, the botanist and pupil of Linnaeus, one of Niebuhr's exploring party. But our visitors had never heard the name; if a man lived a good life in Yarim, we were told, he might hope to reach the age of eighty, but none could remember events which occurred more than one hundred and fifty years ago.

On January 4 the 80 miles between Yarim and San'a was covered by motor in eleven hours. The driver's skill was called into play in negotiating rocky and sandy places and the banks of dry irrigation-channels running obliquely across the track. We squeezed ourselves, our three Somalis, and our small baggage into a Ford box-body car, which had been sent for us, leaving the heavy baggage to follow by camel, in four days, under the care of the *sha'ush* and askaris who had accompanied us from Ta'izz. The greater part of our journey lay over bare brown plateaux between 8000 and 9000 feet above the sea. The apparent barrenness was largely due to the season, for much of these plains is good arable land. Countrymen, whose outer garment consists of a sleeveless sheepskin coat with the wool turned outwards, were winter ploughing with ox-drawn or camel-drawn ploughs. But such hills and mountains as rise above the general level are of black volcanic rock, forming a grim landscape. At intervals great cemented water cisterns and tanks were passed, where people were gathered with numbers of donkeys and mules. Some of these folk, south of Dhamar, were half-naked men, very different in physiognomy from the ordinary hillmen, and probably drawn from the plateaux shelving towards the desert east of the road. Dhamar, an unwalled town, our halfway halt, lies between two old craters a few miles on either side. That on the east, Jebel Hammam Alesi, over 10,000 feet, emits sulphurous vapour from fissures, while to the north-east of it Jebel Haidarlesi boasts a hot spring and baths.

North of the small town of Ma'bar a great range lying athwart the way is

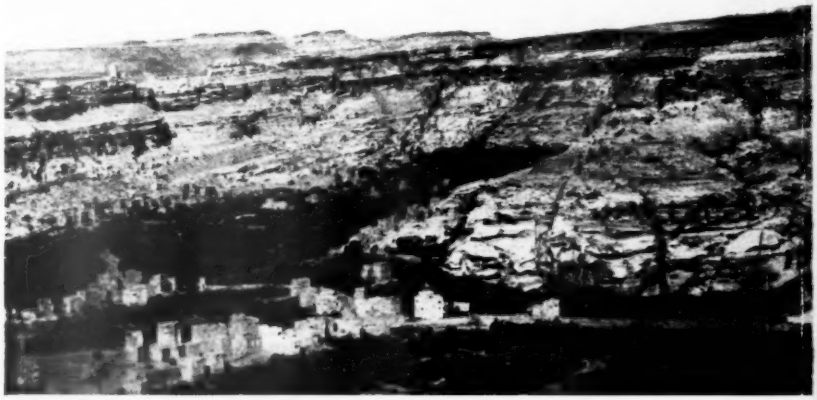
*North-west face of Jebel Jihaf, from Al Muriah in Wadi Tiban. The highest point, 7800 fe lies in the middle distance*

*View southwards towards Ma'bar from th*

*) feet, is the rounded summit to the left of centre; the tomb-mosque of Weli Isma'il*

*the Naqil Isla pass, 9600 feet*

*San'a from the east. In the foreground is the white dome of the Bakiliye mosq*
*the city lies in the background to the right*



*Wadi Dhahr from the south. In the c*

*nosque, with the minaret of Salah ad Din immediately to its right; the western division of*

*he centre on a detached crag is the Imam's house*

*of*

crossed by the new motor road and the old caravan track at the pass of Naqil Isla (about 9600 feet), between the heights of Jebel al Meriat to the east and Jebel Jelal to the west, both over 10,000 feet. The hardness of these grandly shaped mountains is scarcely relieved by a sparse vegetation consisting of tough wiry bushes and low plants. We ascended this pass in January in the growing dusk and cold. On our return journey in March we stopped for some hours at the top in the morning sunshine, climbed Jebel Jelal to a point scarcely below 10,000 feet and found some of our most interesting specimens among the dwarf scrub-junipers and low shrubs on its steep northern face. From Naqil Isla the road descends among foothills and emerges on to San'a plain, about 1000 feet lower than the plateau about Yarim.

After a chilly wait in the dark and some altercation with the guard at the closed Bab al Khusemeh, we were admitted to the capital, and sent to one of the smaller government guest-houses in the Bir al 'Azab quarter. Detention indoors for a few days, rendered necessary by the custom forbidding Europeans to go about till certain courtesy visits have been paid, ended on our third evening. Then we were sought out by Dr. P. W. R. Petrie and his wife, both medical doctors and members of the Keith-Falconer (Church of Scotland) Mission at Sheikh 'Othman (Aden), who, with their small son and Miss Cowie, a nursing member of the same mission, were the only British permanently resident in San'a. After Dr. Petrie had conducted me on the most necessary visits, we got permission to move to his house, where Britton soon recovered from the malaria. So this large Arab house, standing in a big walled garden in Bir al 'Azab, became our base for over two months. We are indebted to Dr. and Mrs. Petrie for every kindness; Dr. Petrie moreover became a keen collector and accompanied us on our excursions whenever he could.

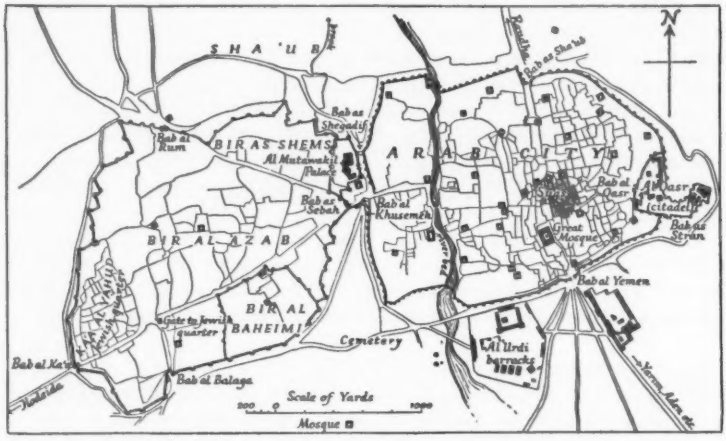
San'a, the largest city in southern Arabia, with a population estimated at from 40,000 to 50,000, stands on a plain at about 7900 feet above sea-level.[1] It extends some $2^{1}_{2}$ miles in a direction a little north of east to south of west, and consists of two principal divisions united only by a narrow waist, so that the whole in plan resembles an irregular figure-of-eight. On the east the old Arab city, its ancient walls strengthened by very numerous semicircular bastions, has a northern and a southern gate, flanked by round towers, leading to the open country; at its eastern end a similar gate opens into the citadel, al Qasr, which is raised a little on a foot-spur of Jebel Nuqum, and whence another gate leads to the country. The remaining old gate, Bab as Sebah, on the west, has been demolished, and the name is applied to a more modern gateway communicating with the western division. There are further two gates, north and south, in the outer walls of the narrow waist uniting the two divisions.

The western division covers an area perhaps larger than that of the Arab city, and is also entirely surrounded by walls, with bastions at wider intervals than those of old San'a, and having three gates to the open country; so that the capital as a whole can be entered, during the day, at seven points, or eight if that through the citadel be included. The western division consists largely of the residential garden quarter called Bir al 'Azab, but at the western end

[1] See note on p. 121.

is the Jewish quarter, Ka'a al Yahud, shut off from Bir al 'Azab by a wall pierced by a gate, also fully equipped with a tower and a guardroom. Thus San'a is often described as consisting of three main parts, though a ground-plan shows that they are better regarded as two. The precincts of the Imam's palace, al Mutawakil, immediately west of the Arab city, in the narrow waist uniting it to Bir al 'Azab, are enclosed within walls of their own. Houses and groups of buildings are also scattered without the walls, notably the barracks and other large nineteenth-century Turkish buildings south of the Arab city, outside the Bab al Yemen.

The remains of a pre-Islamic (Sabaean) stronghold, Gomdan, are believed to lie under the present citadel and part of the Arab city. San'a itself did not rise to great importance till the early centuries of the Christian era, after the




*Plan of San'a, adapted from Rathjens and von Wissmann*

decline of Mareb following on the destruction of its famous dam. The later history of San'a has seen many phases of destruction and rebuilding, so that most that is visible to-day dates from the last four or five centuries.

Old San'a where, in periods of waiting between our collecting trips, we penetrated almost every part of the area enclosed within the weathered walls of sun-dried brick, is traversed from north to south, near the western end, by a broad, dry, dusty water-channel, spanned by a stone bridge only used in times of flood. East of this there is little open space, most of the ground being filled with lofty houses and other buildings, and a few pieces of garden land enclosed by high walls. The unpaved, uneven, narrow lanes form a maze, with sharp turns, often at right-angles, and frequent blind alleys, whence the explorer emerges into little irregular-shaped spaces. Unlike the entirely stone houses of the mountain villages, these town houses are only of stone in the lowest storeys, above which they are of local brick, first sun-dried and afterwards burnt, the substance of which is dug from the aeolian deposits forming

San'a plain. The houses display a wealth of external ornament in relief, picked out in whitewash against the reddish-brown brickwork. The *suqs*, an intricate maze in the centre of the city, consist of little one-storeyed shops. In the dwelling-houses the storeys are three, four, or more, but often fewer than they appear when the windows are seen from outside. For the well-lighted upper rooms, approached through a dark entrance-hall and up flights of stone stairs, usually have a lower range of windows, unglazed but furnished with shutters, just above the floor, and higher up a range of arched glazed windows filled with elaborate tracery of many designs and stained glass. Some of these traceried windows are double, containing two sets of tracery of different patterns, one outside the other. When there are also conventional designs in relief on the walls, ornamented niches and brackets, and handsome carpets, such rooms are indeed beautiful, recalling late Gothic buildings and leading to speculations on the mutual reactions of Oriental and European medieval architecture. The construction of these decorated houses is a living art, seen in progress; Jewish craftsmen are met carrying through the streets traceried windows of stucco, as yet unglazed. The ornamented doorways, nail-studded doors, iron knockers of various designs, and other details cannot be described here. Against this spaciousness and beauty must be set the very primitive nature of the sanitary arrangements of the houses, where all drainage runs down wide plastered channels on the outer walls.

San'a possesses some forty-four mosques, nearly all in the old Arab quarter. When the city is viewed from outside, especially from the foot of Jebel Nuqum, over twenty minarets can be counted. Many are beautifully decorated with designs in relief, picked out in white against the dark brickwork, and differing in every mosque. Built on a rectangular base, each minaret is cylindrical or polygonal up to the projecting gallery, above which it is usually six or eight-sided and topped by a small fluted cupola. Though entry is forbidden to any but Muhammadans, many of the mosques stand free enough from other buildings for their domed roofs and their beauty and variety to be appreciated. That of Salah ad Din, in which the minaret is surmounted by a cock instead of the normal crescent, is shown as one of the oldest. Others, such as the Bakiliye mosque, were built by the Turks in the sixteenth or early seventeenth century. The Jami'al Kabir (the "Great Mosque" at which the Imam leads the prayers each Friday), though presenting externally little but blank walls and two tall white minarets, has within an arcaded courtyard with a small cubical building in the centre, somewhat resembling the Ka'aba at Mecca. The remains of a pre-Islamic building may be incorporated in this mosque, and it has been thought to stand on the site of a Christian church built by the Abyssinian conquerors in the sixth century. But according to Rathjens and von Wissmann, the Great Mosque shows in its ground-plan, which is akin to that of several of the earliest mosques of Islam, traces of derivation from the temples of the ancient sun worship, one of which they excavated at Huqqa. Besides ten doorways in use, the Great Mosque has two other blocked doorways, one near either end of the north-west wall; on either side of both these blocked entrances is built into the wall a large stone bearing weathered sculptures of birds and flowers; it is uncertain if these stones belonged to a pre-Islamic building. In any case, conventional representations of birds, fish, and plants

were to be seen in both exterior and interior decoration of buildings, new as well as old, in several of the places we visited.

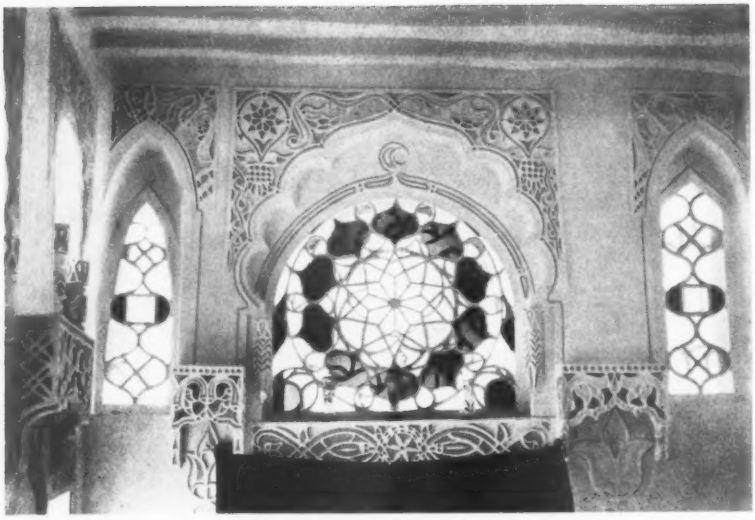
No enumeration of details serves however to convey an impression of old San'a. Pictures remain in the mind of the whole as seen from a distance, whence the more squalid sights are invisible; especially views from the house-roof in Bir al 'Azab, on cloudy afternoons when the hard outlines were softened, and the old Arab city, with Jebel Nuqum, formed a scene of rare beauty.

In contrast to old San'a, Bir al 'Azab, in the western division, is composed mainly of large houses standing apart in big walled gardens. The south portion consists of market gardens with few buildings, and even the enclosures round the houses are often cultivated, not by the occupiers, but by market gardeners. These gardens within the walls are given up to lucerne, carrots, onions, and other crops, as well as fruit trees. Bir al 'Azab is traversed by two wide streets diverging from the Bab as Sebah, where it communicates with the Arab city on the east, running to its northern and south-western gates. The rest is a network of narrow lanes, with several large bare spaces, such as that used as a parade ground in front of the Bab as Sebah. The houses are of Arab or sometimes Turkish construction, the latter much plainer. Another legacy of the Turks is a few cypress trees; one of these had previously served as the roosting-place for a colony of large fruit bats or "flying-foxes" (*Eidolon sabaeus*), of which we secured specimens from Dr. Emilio Dubbiosi, the Imam's physician. To him, and to the other resident Italian doctors, I may record our indebtedness for their kindness.

When taken by Dr. Petrie to visit the 'Amil of San'a, Saiyid Husein 'Abd al Qadir, that genial official, mayor or governor of the capital, received us in a garden pavilion (a *mifraj*) at his house in Bir al 'Azab. While we were seated on the cushions, somewhat precariously balancing cups of coffee on tall brass stands taken from among an imposing array of polished censers, hookahs, and other objects on a monster brazen tray in the middle of the floor, the 'Amil remarked jocularly that Bir al 'Azab, signifying the "well of the unmarried," is a misnomer, since all the inhabitants of the quarter are married. (The derivation Bir al 'Adhab, the well of sweet water, has also been suggested.) One is tempted to adopt the view of some writers, that the name is a corruption of Bir al 'Azal. Azal, the old name of San'a, is traditionally identified with the Uzal mentioned in Genesis (Chapter X) as a son of Joktan (Kahtan) and descendant of Shem. Whatever be the origin of the name, Bir al 'Azab is the quarter whence San'a draws much of its water. Among its fields and gardens are many great wells, about 15 feet in diameter and 60 or more feet deep, whence water is ceaselessly drawn by animals descending inclined planes, which are usually excavated deep into the earth, but sometimes built up above the well's mouth. Camels, donkeys, and oxen are used, singly or yoked, and usually two or three animals descend the plane side by side, drawing up several water-sacks simultaneously by ropes passed over pulleys. By an ingenious device the sacks are emptied into a reservoir beside the well mouth. Water-drawing begins at earliest dawn and continues till dark, or on moonlight nights even through the night, with only short pauses when the boys driving the animals feed their charges with green fodder or carrots. The creaking of the wooden pulleys, well likened to the cries of seagulls, and the shrill song of the

*San'a: houses in the old city, near Al Abhar mosque*

*Raising water in Bir al 'Azab; dung drying for fuel on the right*



*Double-traceried windows and plaster-work in the guest-house, Ta'izz*

*San'a: in the suqs of the Arab city*

camel-boys, are continual accompaniments to life in Bir al 'Azab. These homely sounds become pleasing, and when we left it was hard to believe that we should hear them no more.

In Ka'a al Yahud, the Jewish quarter at the western end of the town, the houses are only two storeys high and have little external ornament. The traceried windows of the Arab city are replaced by plain round-headed openings filled with thin sheets of alabaster. The construction of large synagogues is not permitted, and the Jewish places of worship are low and modest buildings, which would hardly be noticed without the services of a guide. We were taken to one synagogue, a plain little room approached through a small courtyard. A cupboard was opened and several upright objects covered in embroidered silks were disclosed; these proved, when unveiled, to be long boxes, polygonal in section and bound in bright colours, each of which contains a parchment roll of the Scriptures, fastened at either end to a rod with an embossed silver top.

The Jews of south-western Arabia, whom we had seen in nearly every town and village from Dhala onwards, are very different in physiognomy from the Arab tribesmen, not to mention the long curls worn by the men hanging down on either side of the face, and the distinctive dress of the women. The San'a Jews are often noticeably fairer than those in the country districts. Many kinds of craftsmanship are entirely in Jewish hands, such as the famous and intricate San'a silver filigree work and embroidery in silver thread. Some Jewish houses in San'a were remarkably clean, but the same cannot be said of the Jewish quarters in outlying villages and towns.

To expand on the customs and occupations of the people would be out of place, but something may be said of the "Great Id." In 1938 this festival, synchronizing with certain rites of the pilgrimage at Mecca, and lasting a week, fell in February. Then the townsfolk appeared in their brightest and newest clothes, and the display of long coats, of shawls worn over the shoulders and turbans of every colour, silver-embroidered caps and belts, was almost kaleidoscopic. On the culminating day, Thursday, February 10, the Imam went in procession early to lead the prayers at the Meshhed, a great mosque in the form of a large walled enclosure fully open to the sky, standing outside the Arab city to the north-east, and used annually only for this purpose. The road from the Bab as Shegadif, close to the palace, to the Meshhed was lined by foot-soldiers, and bands played gaily. The procession was headed by mounted soldiers, but the Imam was immediately preceded by his personal bodyguard of foot-soldiers, who war-danced and sang, holding their daggers aloft, as they moved forward. The king rode in the heavy ornamented carriage in which he usually drives about his capital, drawn by two pairs of horses with postilions, while a man walked beside, holding over the carriage a huge umbrella about 8 feet across, bright orange with a green fringe, which the bearer bounced up and down and twirled round. Later there was a march-past of several thousand troops, as well as detachments of schoolboys in new striped silk garments, embroidered caps and belts, and yellow-coated orphan boys from the schools where they are educated free by the Government. Each detachment was headed by the national flag, the white sword and five white stars on a scarlet ground.

The Imam held a reception for his own subjects after the review, and two days later the male Europeans in San'a were invited to a special audience at 9 a.m. About seventeen of us, of four nationalities, went up a wide curving stone staircase and along a corridor in a lower part of the palace, projecting from the great six-storeyed main building. We were given chairs along the sides of an elaborately decorated audience-room, at the far end of which the Imam, on entering, occupied a carved wooden seat, faced by his first minister at the end nearer the door. The proceedings were confined to courteous inquiries and a few friendly remarks on the part of the Imam.

Our private audience took place at 4 p.m. the following day, in the Maqam Sharif, a small room, long and narrow, opening off the corridor mentioned above. Here we were received in the manner of the country, and seated (shoeless and wearing as headgear the black lambskin *kalpaks* prescribed by custom for Europeans) on cushions at the foot of the wall facing the Imam. The latter was not arrayed in the rich white brocades he had worn at the festival, but in a plain striped garment, while the gold-scabbarded sword, carried as emblem of his rank on ceremonial occasions, hung on the wall. Though not tall, and of a less commanding presence than some of his subjects, the Imam Yahya nevertheless impresses visitors by his personality and his immense industry. He was hard at work, for at seventy he still toils almost ceaselessly, personally controlling the smallest administrative details. His prime minister was seated on his right, and around lay piles of papers of all shapes and sizes, which the Imam was rapidly signing and annotating, throwing them aside to clerks seated on the floor in the middle of the room. These men stamped the documents with seals of various kinds, circular or triangular; some were stamped in black, others with red ochre, with which the handwriting on many papers is also smeared. One explanation of this custom is that it symbolizes the Imam's succession to the throne of the Himyaritic princes, whose flag was red. The Imam however for some time interrupted his labours, asked us many questions about our motive for visiting his country and the practical uses of our work, and looked at the specimens and apparatus we had brought. To make our object clear presented difficulties with which we were by this time familiar, and we tried to draw attention to the practical benefits resulting from scientific research. This led to inquiries about a very rare stone reputed to cure snake-bite by its touch. The Imam was however turning back to his work, and I was warned by his foreign minister (who was interpreting) to be quick in expressing our gratitude and making certain requests.

Here I may fittingly tender our thanks to the two ministers mentioned. The prime minister, Qadhi 'Abdullah al 'Amri, an Arab of dignified presence, displaying great interest in the history and traditions of his country, received us several times at his house to discuss arrangements. These visits took place at 8 a.m. or earlier, for the Wazir works as hard as his master and attends early at the palace. The foreign minister, Qadhi Muhammad Raghib, a Turk and former member of the Turkish Diplomatic Service, fluent in French, so that no linguistic difficulties hindered the establishment of very friendly relations between us, showed us constant kindness.

The coldest part of the winter, with several degrees of frost, was over before

*The Imam's new house in Wadi Dhahr*

*San'a: the minaret of Salah ad Din mosque*

*Wadi Masnah and Jebel Subʿ Doran from the brink of Jebel Masnah*

*Sanʿa plain: ploughman followed by men wielding heavy shovel with pole and cords*

*Jebel Masnah*

*shovel with pole and cords*

we reached San'a, and the lowest night minimum recorded between January 4 and March 8 was just over 33° F. The clear days of the dry season, becoming hotter, were broken by occasional afternoon rainstorms, as on January 19, when a dull morning was followed by a rainy afternoon, the first real rain we had seen since a smart afternoon fall at Ta'izz on December 15. The phases of spring succeeded one another swiftly. In the orchards apricot trees, bare at the beginning, were in full bloom at the end of January and in full leaf, with green fruit, a month later. Fig trees put out young leaves early in February; quinces and pomegranates were in bloom, but walnuts still almost bare, early in March. Under these conditions we worked at every opportunity, even within the walls of Bir al 'Azab, or in fields just outside, as at Sha'ub, immediately north of the city, where a brook bordered by pollard willows winds through irrigated fields, in which green wheat was in ear in late February. Except in such irrigated places the fields on San'a plain were under the plough. The ploughman and his oxen were sometimes followed by a team of three men with a heavy iron shovel.[1] One man wields this by its long wooden handle, the others hold cords fastened to the iron; the shovel is alternately lifted, then dropped and pulled sideways by the cords, so that the furrowed soil is shifted to one side, as by the curve in a modern ploughshare.

Several places within a day's excursion, for which no special permit is needed, were visited. Such are the wadis at Bait Baus, Al 'Asr and Wadi Dhahr, in the bare, stony hills to the south, the west, and the north-west, where springs render possible the existence of villages and orchards. At Bait Baus an extraordinary walled village is huddled on a great detached horizontal slab of volcanic rock, part of the vast series of ancient trap poured out over the sandstones of the Cretaceous period, and extending over much of the country round San'a; the streets of Bait Baus are formed by the living rock, and the outer walls are on the edge of nearly vertical cliffs. The wadi above the upper and lower villages of Al 'Asr commands a distant view of San'a and Jebel Nuqum, framed by the walnut and apricot orchards near at hand, with the upper village perched on an eminence to the right; from the valley-head, streams, welling out at the foot of barren cliffs, are conducted to the cultivated ground through roofed-in channels pierced at intervals by circular shafts, a construction said to be Himyaritic. Wadi Dhahr, about 6 miles north-west of San'a, is a winding valley, opening out to the north-east, between bare reddish cliffs of Cretaceous sandstone, with Jebel Fiddi, a naked volcanic neck, towering immediately to the south; the flat floor of the wadi is crammed with walled gardens of fruit and *qat* trees, and groups of buildings, among them an amazing new country house of the Imam, consisting of three storeys and a roof terrace, perched on a detached rock.

Of two outlying districts visited with the Imam's express permission, Bilad Hamdan comprises country of a very different kind, and includes our northernmost point, Jebel Kohl, a crater about 15 miles from San'a, a little west of north. Though never more than about 17 miles from the capital, our daily journeys (January 31 to February 5), coupled with the nature of the ground

[1] A tool described as characteristic of Yemen by Niebuhr in 1772 ('Beschreibung von Arabien,' p. 155, pl. XV) and by Rathjens and von Wissmann in 1932 ('Vorislamische Altertümer,' p. 28).

and the want of shade, were arduous enough. Our caravan of fifteen persons and twelve mules involved the carrying (as on all such treks) of bags of heavy silver reals (Maria-Theresa dollars), manufactured in Europe, and the small bronze coins minted locally, *bukhshas* and half-*bukhshas*. Huqqa, reached the first day, is a small town on the southern edge of the grim black volcanic country of Arhab, near rough beds of scarcely weathered lava. These volcanic formations are very much younger than the outpouring of trap mentioned above; the more recent outbreaks are believed to have started in the Pliocene, and to have continued, in successive phases, into historic times. Near Huqqa however there are also stretches of excellent vineyards, enclosed in high walls of black lava blocks, which appear on the skyline as a fretwork. Huqqa was the scene of excavations in 1928, by Dr. Rathjens, of an ancient temple to the sun goddess Ba'dan, and destroyed in the early centuries of the Christian era by the last volcanic outburst. Some lower courses of black masonry are visible, together with shafts opening into a vast subterranean cistern beneath the temple, and fragments of white sculptured stone are built into the houses of Huqqa. Little can be discerned of the complex system of buildings, including a rectangular court with pillared passages round three sides, of which the ground-plan was exposed. Some of the stonework has been used locally, and the more valuable objects were taken to San'a.

Jebel Kohl, an extinct crater 4–5 miles north-west of Huqqa, not previously visited by Europeans, is not a perfect crater like Kaulat al Hauri, a few miles south. As its west side is missing, the hill forms a great horseshoe with a narrow ridge-top, lying about 9000 and rising to 9500 feet. The desolate country north, north-east, and north-west, bare reddish volcanic hills and cones contrasting with black hummocks and ridges of lava, ends eastwards in yellow sandstone, and to the south lies San'a plain, with its cultures, towns, and villages. Yet among the loose reddish stones of Jebel Kohl many plants were flowering, such as the low tufted *Minuartia* (*Arenaria*) *filifolia* and a rare lavender (*Lavandula atriplicifolia*) with hanging clusters of small yellow flowers. Small insects were found at the roots, and certain butterflies, with their predilection for isolated high points, flew rather wildly about the top of the ridge. In our eagerness to ascend Jebel Kohl some of the party outstripped the *sha'ush*, whose orders as to our movements were very strict, and I vividly recall that officer rushing up the steep slope after the forerunners with his rifle in one hand and a silver-handled umbrella in the other.

On the 15-mile ride westwards to Haz, about 3 miles from the start, lies Birkat Qa' Raqqa, a very large, round, pre-Islamic water-hole of simple type, with sides not "stepped" but falling in a single nearly vertical drop to the water; most of the ancient cement lining has been replaced by rough stone walling, and four rough inclines, serving as many villages, give access to the water. This cistern was inhabited by an exceptionally large species of "water-boatman" (*Notonecta*). Beyond this place an ascent of 1300 feet leads to the Al Kabar pass (9300 feet), whence the track descends only about 100 feet through the remaining 8 or 9 miles to Haz. On the western side of the pass the furrows were bright green with very young cereals.

Haz is a walled stone-built town with a ruined *qasr*. The lower courses of part of the walls and of the *qasr* are pre-Islamic, consisting of very large

squared blocks of black stone, while white Himyaritic stones are numerous in this and other buildings. South of the town is a separate Jewish quarter, where we were lodged for three nights on the first floor of a house. Our room was rather verminous, and also infested with grain-weevils (*Calandra*), for agricultural produce had been hurriedly cleared out. We were subject to the insatiable curiosity of the Jews in outlying places, and were watched through our windows by a crowd of both sexes outside. Even after closing the shutters we were open to the gaze of the ladies of the household, through holes in the inner wall giving on to the staircase, but we stuffed our rolled-up mosquito-nets into these openings.

The environs were productive from our standpoint, especially the edges of Birkat al Bu'r and some other large ponds within a mile north. These were constructed in ancient times by the damming of a valley, and have walls of masonry in parts, while elsewhere they are bordered by large rocks and patches of short green turf. Al Errein, a hill rising north of the ponds to about 100 feet above the level of the town, is a pre-Islamic site, on top of which loose blocks of black stone, and a white octagonal column about 4 feet long, lie among rank vegetation. At a hill called Kaulat al 'Asakeir, close to the village of Bait al Ghofr, a curious bare black slope of volcanic rock had in its crevices patches of tufted *Dianthus*, of a creeping scabious (belonging to the section *Pterocephalus*), and a *Silene* not previously seen.

During a journey to Bilad Senhan (February 16–18), the small hill town of Ghaiman, about 13 miles by road south-east of San'a, was our centre. It is perched on steep crags several hundred feet high, reaching an altitude of nearly 8800 feet, and overlooking a fine and varied landscape of fertile flat-bottomed valleys, plantations of tamarisk, terraced slopes, and barren yellowish-brown mountains. The old head man and his people, very friendly and particularly healthy-looking, put at our disposal a little upper room, with tiny windows, in a rough stone house. Ghaiman stands close to an historic site, where in 1931 was excavated the grave of a great Himyaritic monarch, Tubba As'ad Kamil, who according to Jewish tradition was the first Tubba to embrace Judaism, even before the end of the fourth century; but the tradition is contested by the Arabs, who hold that not this Tubba was converted but one of his successors, possibly the last, Dhu Nowas, who was destroyed by the Abyssinian invasion in the sixth century. (This statement is based on information received from Dr. Rathjens.) A great rectangular ancient cistern with sides of shaped and dressed stone, called Migyal al As'ad, had been cleared out and repaired under the supervision of the eldest son of the Imam. It contained little water, and we descended by a flight of projecting stones to collect specimens among the rank pond vegetation. The search for insects and plants also led us to a height of 9200 feet on the stony slopes of Jebel Girwan, a fine example of step-formation in which alternation of softer and harder layers, apparently belonging to the ancient series of traps, has produced an outline of alternate steep slopes and precipitous cliffs, rising to a horizontal top at 10,000 or more feet.

Our experiences in the highlands have purposely been related at length, and the account of our journey to Hodeida must be brief. The decision of the

Imam that we were to travel by the motor route, *via* Madinat al Abid, and not by the old mountain mule road through Manakha, surprised us in view of what he had previously allowed. But the grandeur of the country traversed by the motor road was some alleviation of our disappointment. Leaving San'a by motor on March 8, we passed two nights at Ma'bar. March 9 was devoted to collecting on Jebel Masnah, some miles south-west, at 8400 feet, a spot memorable for the magnificent view down Wadi Masnah and the capture of several species of burnet-moths (*Zygaena*). On March 10 the descent through the wild and rugged Wadi Masnah led to Hammam Ali, where there are several hot springs, and numerous little rough stone dwellings only occupied at intervals by visitors to the baths. A large crowd was assembled, as some of the fourteen sons of the Imam were staying there for treatment. The exhilarating climate of the highlands was behind us, and when we halted in the wadi a little below the thermal establishment, at 5600 feet, under a great wild fig tree beside fields of green *dhurra* and rank grass fringing a running stream, the heat and the numerous butterflies were tropical.

At Madinat al Abid the valley widens into a broad luxuriant expanse of fertile land, with patches of large forest trees, and ringed by rocky mountains. This place however is very malarious. The route leads thence north-westwards through another wild valley to Wadi Jaira, at about 3000 feet altitude, and thence to Ghailima, about 2200 feet, where we camped on dry stony ground sparsely covered with thorny trees, then leafless. Next day (March 11) we were in the lowlands and among the tribes of the Tihama, who differ much from the highlanders in appearance and dress, particularly in the tall wide-brimmed straw hats worn by the women. Wadi Siham is a broad open valley, but still surrounded by grand mountains, the hard outlines of which were softened to great beauty by haze and cloud. When 'Obal, Behih, and Bajil were passed the last spurs of the hills were behind, and the track lay through the Tihama desert belt, dotted with dwarf bushes, each growing out of a mound formed by the accumulation in its branches of wind-driven sand. Finally the vegetation assumes a coastal type, the sea comes into view, and a run southwards along the coast ends the journey to Hodeida.

In this chief port of the Yemen, a place very different from any described above, we stayed four nights, liberally entertained at the great government guest-house facing the sea, but closely watched as to our movements. The Amir, Saiyid 'Abdullah ibn al Wazir, a man of noble mien, but very distrustful of us, would not consent to our travelling by the lowland route to Ta'izz. Lack of means of transport was perhaps in part the cause. But it was already impossible to reach England within the limits of our leave of absence, so a chance of making Aden by a Lloyd-Triestino steamer was gladly seized. On March 15 we left Hodeida in a sambuk, and, after tacking up and down the coast for two hours, embarked on the steamer several miles out. After calls at Assab and Djibouti she reached Aden on March 19, and we left by British mail steamer for Marseilles on March 23.

It is a pleasure to acknowledge the generous support which I received in my project. The Trustees of the British Museum gave the necessary leave of absence and a substantial financial contribution to myself and Mr. Britton. The Leverhulme Research Trustees, by naming me one of their Research

Fellows, made a very material contribution, and grants were received from the Royal Society and the Trustees of the Godman Fund. We wish also to express our great indebtedness to the Government of Aden, for the kindness shown us by Sir Bernard Reilly, K.C.M.G., the Governor, and the hospitality of Lieut.-Colonel M. C. Lake, C.M.G., the Political Secretary, who was acting as Governor during much of our time in Arabia. We were constantly helped and advised by Captain B. W. Seager, the Frontier Officer, whose house we shared during our stays in Aden, and, in the Dhala highlands, by Captain the Hon. R. A. Hamilton, Second Political Officer. Before leaving England I had also benefited from the experience of the Yemen gained in former years by Commander C. E. V. Craufurd, R.N. (ret.). In the Yemen we were the guests of the Government during parts of our stay, and acknowledge our indebtedness to His Majesty the Imam for the kind reception he accorded us. Some of his ministers and governors have been mentioned, as well as our debt to Dr. and Mrs. Petrie in San'a. Dr. Carl Rathjens, whom we met in Ta'izz, assisted us greatly in getting permission to visit San'a. Many unnamed persons, some of them in humble walks of life, also helped to render successful our journey to the western Aden Protectorate and the Yemen.

*Bibliographic note.*—Among numerous works consulted for general and historical information I am specially indebted to the following: G. Wyman Bury, 'Arabia Infelix, or the Turks in Yemen' (1915); Walter B. Harris, 'A journey through the Yemen' (1893); and Lieut.-Colonel Harold F. Jacob, 'Kings of Arabia' (1923). The 'Vorislamische Altertümer' and 'Landeskundliche Ergebnisse' of Carl Rathjens and Hermann von Wissmann, forming volumes 2 and 3 (Hamburgische Universität, Abhandlungen aus dem Gebiet der Auslandskunde, Band 38, 1932, und 40, 1934) of the 'Südarabien Reise' of these authors, have enabled me to check historical and geological points concerning the city of San'a and the surrounding country.

*Note on altitude of San'a* (see p. 111).—The approximate figure of 7900 feet is higher than that given on some maps. The International Map (1 : 100,000, 1926) gives 2300 metres (7546 feet); the map G.S.G.S. No. 3108 (1 : 253,440, corrected 1917) marks 7544 feet a little south of the city; the map of San'a and district attached to the work of Rathjens and von Wissmann (1934) cited above gives 2350 metres (7710 feet). Possibly these figures were obtained at a point in the vicinity lower than our base. Our figure was arrived at by repeated aneroid readings which, at the same time of day, always lay between 7900 and 7950 feet. These readings, taken at Dr. Petrie's house in Bir al 'Azab, agreed with aneroid readings taken by Mr. Martynik, a Polish engineer then in the service of the Imam, who lived a short distance away, and whose instrument registered 2420 metres (7940 feet). We tried to check our aneroid readings by a boiling-point test, using distilled water, but were hampered by the want of a proper apparatus, since we had left ours at Aden, thinking that its use would excite suspicion. Subject to this limitation the boiling-point, about 197° F. on 7 March 1938, confirmed the aneroid readings.

## APPENDIX I: THE USE OF *QAT*

EVERARD B. BRITTON

The use of the drug known as *qat* is restricted to the mountainous regions of south-west Arabia and parts of Abyssinia and Somaliland. The plant *Catha*

*edulis*, the source of the drug, was first described by the Danish botanist Forskål, in his posthumously published 'Flora Aegyptiaco-Arabica,' in 1775. It is a species of the family Celastraceae, to which the English spindle tree belongs. *Catha edulis* is a native of East Africa, growing at fairly high altitudes between lats. 15° N. and 30° S., and was introduced from Abyssinia into Arabia. It is a woody shrub growing to a height of about 10 feet, having serrate leaves and small white flowers in axillary cymes.

In south-west Arabia, where *qat* is used by a very large proportion of the population, the fresh leaves are chewed, but the dried leaves may also be taken, or infused and drunk as tea. The addicts claim the most varied and often contradictory properties for the drug. All agree however that it produces wakefulness and a feeling of well-being and mental alertness. It induces thirst, and water is drunk at intervals during *qat*-chewing. Taken in excess *qat* produces symptoms which, to the observer at least, simulate alcoholic intoxication. *Qat*-eating commences after midday, and "*qat* parties" often continue until the early hours. (Our personal observations are confirmed by A. Deflers, 'Voyage au Yemen,' 1889, pp. 121–2, and other works.)

Each plant is said to produce three crops a year. The sprigs, 6–8 inches in length, of younger leaves are picked and bound into small bundles, which in turn are wrapped for protection in grass. In this way the drug is kept in good condition for about a week, and so can be carried to Aden by camel. In Arabia the tree is cultivated at altitudes between about 5000 and 9000 feet, on the mountain terraces. Its optimum conditions of growth seem to be similar to those for coffee. In the Aden Protectorate the necessary conditions are found only in the mountains near the Yemen frontier; at Dhala (4800 feet) the growth is stunted, the plants being no more than a foot in height, while they appear to attain their maximum growth on the terraces of Jebel Sabir, near Ta'izz in the Yemen, a district where the rainfall is comparatively great.

Taxes levied on the cultivation of *qat* produce a considerable revenue for the Government of Yemen.

The plant has been introduced into France and the U.S.A., where it is said to grow well in the south.

Stockman (*Journal of Pharmacology and Experimental Therapeutics* 4 (1912) 251) isolated three alkaloids from the wood and leaves. These alkaloids, which he named cathin, cathinin, and cathidin, by the similarity of their effects evidently belong to the same group and differ only in details of pharmacological action. The chemical composition of cathin has been established by Wolfes (*Archiv der Pharmacie* 268 (1930) 81–3) as identical with d-nor-isoephedrine. It acts upon the cerebrum and spinal cord, causing stimulation or much excitement according to the dose. Although it appears that cathin is less toxic than the caffein contained in tea, addiction to *qat*-eating is harmful owing to the large quantities of tannin and other substances which are ingested.

## DISCUSSION

Before the paper the CHAIRMAN (Professor KENNETH MASON) said: We are sometimes accused in this Society of having too many papers dealing with ice and snow. This however is the third lecture this session on country in the neighbourhood of the Red Sea, and not the least interesting by any means. I now have to introduce Dr. Hugh Scott, of the Natural History Museum, who is going to talk to us about the Yemen.

*Dr. Hugh Scott then gave the paper printed above, and a discussion followed.*

Mr. E. B. BRITTON: Dr. Scott has had little time to-night to say much with

regard to the scientific aims of the expedition and the work we did, and I would like to add a word or two. Our main object was to amass as large a collection of the insects of the country as was possible in the time.

The idea of the expedition to south-western Arabia originated from Dr. Scott's earlier expedition to Abyssinia. Arabia as a whole is of great interest to biologists on account of its position, bounded on all sides by separate and distinct faunas; to the west there is Africa with a very distinct fauna; on the north, the Palaearctic region; and to the east, India. It was in order to get material to help in the elucidation of the problems connected with biogeographical distribution that we went to the Yemen. The fauna of the Yemen, at least in the lowlands and the foothills, is mainly African, and one sees, for instance, the usual African butterflies. One of the most important results of Dr. Scott's expedition to Abyssinia was the discovery that on the very top of some of the highest mountains of central Abyssinia there is a Mediterranean faunal element, a sort of island in an African fauna, and we suspected that something similar would occur in the Yemen. In fact we found it did; for instance I clearly remember arriving at the top of the Sumara pass early one morning and discovering underneath stones beetles which were undoubtedly northern forms.

I should add that the British Museum has in recent years received some very interesting collections from various parts of Arabia, notably those made by Mr. Philby and by Mr. Bertram Thomas. Our collection will fill in a further gap in our knowledge of the fauna of Arabia, but there still remain areas which are quite unknown. The Museum would welcome for instance material from any part of southern Arabia east of the Hadhramaut, but particularly from the Qara mountains, where Mr. Bertram Thomas collected, and from the mountains of the hinterland of Oman, which, I believe, are quite unexplored from any point of view.

I must mention the three Somali boys who were with us for the whole six months of our stay. They were excellent in every way. Very intelligent and very patient and keen-sighted, they turned into most excellent collectors. On the whole they were very cheery people, with an extreme love of fighting, or at least of talking about it. I remember one of the boys saying one day that he wanted to save as much of his wages as possible—to go back to Somaliland and buy a good rifle with which to shoot his uncle!

Although the collection of insects was our principal object, Dr. Scott collected about six hundred plants. Many of these had never previously been received by the Botany Department, and in the case of other species no examples had been received since those originally collected by Forskål in 1763, which passed into the herbarium of Sir Joseph Banks and after his death in 1820 to the Botany Department of the British Museum. Forskål was a pupil of Linnaeus and a member of the first scientific expedition to visit the Yemen. The story of that expedition was tragic, for of the five members only one, Niebuhr, survived to return to Europe and publish the results. Forskål himself died at Yarim in July 1763. There is little doubt that he and the others were victims of malaria, which flourishes in its most deadly form in the lower valleys of the Yemen.

In conclusion, I should like to express our deepest thanks to the officers of the Royal Air Force at Aden. They were most kind to us, and gave us the greatest assistance in bringing up our mail and supplies from Aden during the months we spent in the Dhala highlands.

Mr. N. D. RILEY: I feel there is little I can add to the interesting lecture to which we have listened from Dr. Scott, because although I have been intensely interested in the expedition throughout, I have never myself got beyond the base camp, and the base camp never got beyond South Kensington. I have

been not only greatly interested in the lecture itself but more particularly perhaps, in the pictures. It may sound odd to you that Dr. Scott's lecture should be less of a novelty to me than his pictures, but I may venture to remind you that once he has made up his mind to any particular action he is a very difficult person to set aside. I say this rather feelingly because I am nominally in the position of being his boss: that is to say I am officially his Keeper. However, joking apart, I must confess I consider myself extremely fortunate in having amongst my colleagues two such men as Dr. Scott and Mr. Britton.

I welcome this opportunity of saying that the whole credit for the expedition is in its inception, its organization, and carrying through due to Dr. Scott. If in the evolution of the expedition it became known as the British Museum Expedition, that is only another proof of Dr. Scott's capacity for making the fullest use of every available scrap of cover in approaching his objective. It is a further feather in their caps perhaps that, in spite of my having placed in the way of Dr. Scott and Mr. Britton all those obstacles for which heads of departments are notorious, they yet managed to carry the expedition through most successfully, and even wound it up by thoroughly overstaying their leave.

Mr. Britton has already spoken with regard to the objects of the expedition from the point of view of studying the distribution of insects. I am particularly interested in butterflies, and there are a number of strange puzzles in connection with those insects which the expedition to this rather critical area in south-western Arabia may help to solve. How for instance does it happen that away down in central Africa in places such as Ruwenzori we find a butterfly which is almost indistinguishable from our own Small Copper, and another extremely like our large Cabbage White? Then again in Abyssinia, as Mr. Britton has mentioned, you find not only the Palaearctic beetles to which he referred but also kindred butterflies; there are two I can think of at the moment, one very much like our common Wall Brown and another like our Orange-Tip. Again, our Swallow-tail butterfly, which in this country is confined to the Fens, is dotted about in the A'haggar mountains, in the central Sahara, in the Yemen, and then skips right across Arabia to the oasis of Al Hufuf. It is hoped that collections from this south-western corner of Arabia will help us a great deal in our endeavour to discover how these butterflies get into these outlandish places.

I think Mr. Britton has already alluded to that aspect of the expedition in sufficient detail for me not to comment on it any further, but it might be interesting to you to know the extent to which, in terms of specimens, this expedition was successful. In six months the expedition got together something like twenty-six thousand specimens of insects. They also obtained many scorpions, centipedes, spiders, and wood-lice. They collected some five hundred or more freshwater and land shells, also snakes, lizards, bats, frogs, and a large number of plants. The work of preparing these collections is a slow one, but we have already made considerable progress; enough in the case of the shells, for instance, to enable Major Connolly to say that there are in the collection one new genus and ten new species, which is considerable. The insects are so numerous that we have not had time to assess them. Obviously there are very many new ones, and the facts of interest in connection with problems of distribution will be very many. To attempt any sort of analysis now would be not only entirely premature but inopportune.

There is one other matter to which I should like to call your attention. I want to take this opportunity of saying what a pleasure it is to us in the Natural History Museum to have this association with the Royal Geographical Society. In the past we have gained much through expeditions which you have organized

and of which we have had the collections. To mention a notable example there were the collections made by the Mount Everest expeditions; and on many other occasions you have given us similar valuable help. I hope that perhaps to-night Dr. Scott and Mr. Britton of the Museum may have brought something from our side of more than just passing interest.

The CHAIRMAN: Aden, as you know, for a long time was under the Government of India. It celebrates its centenary as a British Protectorate in January next year. It is however the youngest of our colonies, having, I believe, become a colony only in April 1937. We have with us this evening Sir Cosmo Parkinson and various other representatives of the Colonial Office. I should like now to thank them on behalf of the lecturer for all the help that they have given this important expedition.

The photographs we have seen to-night were extraordinarily good. I was surprised to see how much vegetation there was in what I had always thought of as a particularly barren part of the world. I should like to ask Dr. Scott what camera he used and a little about the photographic conditions.

Dr. HUGH SCOTT: We had three cameras. I had an Ensign quarter-plate (f/4·5); we had a Rolleiflex (f/3·5) which takes $2\frac{1}{4}$-inch square pictures, and Britton had a Voigtländer (f/6·3) which takes an intermediate size, $3\frac{1}{4}$ inches by $2\frac{1}{4}$ inches. We attribute a good deal of our success to the photo-electric exposure meter we had with us, and we never took a photograph without registering the strength of the light, excepting snapshots where no time was available for doing more. Our exposure meter was the Weston Universal, and it never failed us. We had to change the index-number on the meter; it was 16 for the Selo fine-grain panchromatic roll-films used in the Voigtländer, 20 for the Agfa "Isopan" (fine-grain ultra-rapid panchromatic) rolls used in the Rolleiflex, and 24 for the Agfa "I.S.S." (fine-grain "super-special" panchromatic) film-packs used in the Ensign. All distant and many average views were obtained by setting the camera on a stand and using the smallest stops, f/20 to f/29 (usually f/22 or f/25), giving a correspondingly longer exposure. For instance f/22 and one-tenth second was a common exposure, and, since a yellow light-filter was frequently employed (to gain increased contrast in tones) for distant panoramas and average views of scenery and buildings, this exposure was then increased to one-fifth second, or, with even smaller stops and at times of day when the light was weak, to one-half or even a whole second. We sometimes tried a green light-filter, requiring about four times the registered exposure, but this gave no perceptible advantage; when exposures of the same subject were made in duplicate, with the yellow and green filters respectively, the results are virtually indistinguishable.

The CHAIRMAN: It only remains for me to ask you to give a very hearty vote of thanks to Dr. Scott and Mr. Britton, and also to their Keeper.

# THE SOURCES OF THE BRAHMAPUTRA, INDUS, SUTLEJ, AND KARNALI: WITH NOTES ON MANASAROWAR AND RAKAS TAL

SWAMI PRANAVANANDA

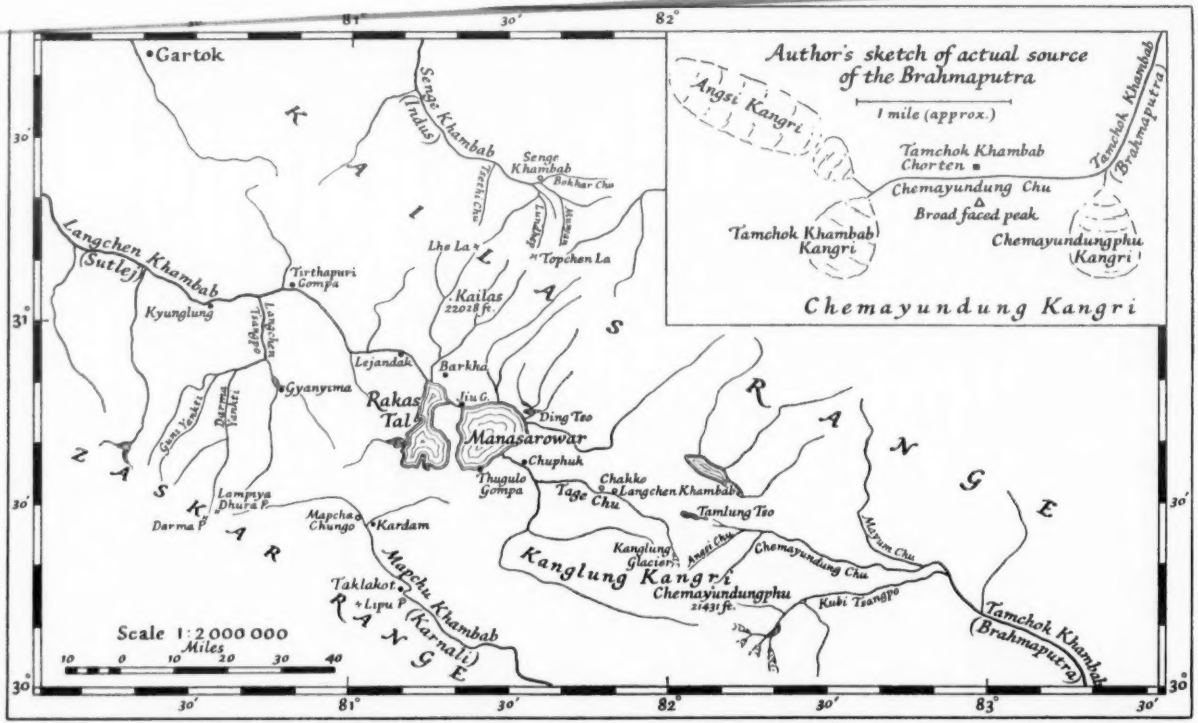
"LAKE MANASAROWAR is famous in Hindu mythology; it had in fact become famous many centuries before the lake of Geneva aroused any feelings of admiration in civilized man. To the north of Manasarowar stands the sacred peak of Kailas, reverenced in Sanskrit literature as the paradise of Siva. Before the dawn of history Manasarowar had become the sacred lake, and such it has remained for four millenniums. Its inaccessibility has enhanced its sanctity, and has enshrouded it in mystery." [1]

The "Kangri Karchok"—the Tibetan Kailas Puran—says that the four great rivers called Langchen Khambab, or the Elephant-mouthed river (Sutlej), on the west, Senge Khambab, or the Lion-mouthed river (Indus), on the north, Tamchok Khambab, or the Horse-ears-mouthed river (Brahmaputra), on the east, and Mapchu Khambab, or the Peacock-mouthed river (Karnali), on the south, have their sources in Tso Mapham, the lake unconquerable (Manasarowar). The water of the Sutlej is said to be cool, the water of the Indus hot, that of the Brahmaputra cold, and that of the Karnali warm. It is also said that there are sands of gold in the Sutlej, sands of diamonds in the Indus, sands of emeralds in the Brahmaputra, and sands of silver in the Karnali, and that these rivers encircle Manasarowar seven times before taking their courses towards west, north, east, and south respectively. There has long been a controversy over the sources of the first three of these rivers. Dr. Sven Hedin gave his final verdict in 1907–08.

I had the good fortune in 1928 to travel in western Tibet on a visit to the Holy Kailas and Manasarowar. I went from Srinagar, through Ladakh, Demchok, Gartok, Tirthapuri, Gyanyima Mandi, round Kailas and Manasarowar, to Taklakot, again to Gartok and back to Rishikesh by the Niti pass. In 1935 I made a second journey from Gangotri and Bhaironghati, by the Jelukhaga pass, Tuling, Gyanyima Mandi, Kailas, Manasarowar, and back to Rishikesh by the Damjan-Niti pass. In 1936–37 I travelled from Almora by the Lipu pass and returned by the same route. During the third visit I stayed for a year in the Thugulo monastery, on the southern shore of Manasarowar, when I had the rare opportunity of visiting the sources of the four great rivers of the Holy Lake. I feel therefore that I have something to say on the verdict of Sven Hedin regarding the sources of the Sutlej, the Brahmaputra, and the Indus.

At the very outset I would like to ask geographers, geologists, and surveyors how the source of a particular river is to be fixed. If the river in question happens to have more than one headstream, which of them is to be considered the main river? Is it decided by the quantity of water that it brings down, or by the length of the particular headstream, or is the source

[1] S. G. Burrard and H. H. Hayden, 'A sketch of the geography and geology of the Himalaya mountains and Tibet.' Delhi, Survey of India, 1934 (Part III, p. 228).




*Sketch map showing the sources of the Brahmaputra, Indus, Sutlej, and Karnali, based on material supplied by the author*

located from the traditions of the local people? If all three factors are to be taken into consideration, it will be impossible to locate the sources of the four great rivers of the Holy Kailas and Manasarowar, and other Himalayan rivers, inasmuch as none of the headstreams fulfils all the three conditions. If all the three conditions are not fulfilled, which of them should be given the greatest weight?

The Sutlej, the Indus, the Brahmaputra, and the Karnali are considered sacred by the Tibetans, and their sources are regarded as even more sacred. In Tibet it is the custom to erect a monument in holy places, and on the tops of passes wherefrom some holy place is first seen. The monument may take the form of a *chorten* (a pagoda-like structure), *mani*-wall, some *mani*-stones or slabs (on which the Tibetan sacred *mantra*, "Om ma ni pad me hum," is carved), cairns, coloured flags and festoons, or even heaps of stones (known as *laptche* in Tibetan). It is not strange to expect such holy monuments at the sources of the four rivers of the Holy Manasarowar, and Sven Hedin gives detailed descriptions of them at the sources of the Indus, at the spring Langchen Khambab on the banks of the Tage Chu, at the spring Chakko (its correct name is Chumik-Thongdul), and at several other places. When he describes the source of the Brahmaputra, he makes no mention whatsoever of these symbols, which are so common in Tibet.

According to Tibetan tradition, the source of the Brahmaputra lies not in the Kubi glaciers, as claimed by Sven Hedin, but in the Chemayundung glaciers. While locating the sources of the Indus and the Sutlej, Sven Hedin refers to all the Tibetan traditions at his disposal in support of his findings. When the question of the source of the Brahmaputra comes in, he does not give any authority but that of a vague quotation from the 'Elements of hydrography,' by the Chinese professor Chi Chao Nan, which runs thus: "Langchen-kabab lies south east of Kailas. On the east of this mountain stands the Tamchok-kabab mountain which is the source of Tamchok-kabab or the Brahmaputra." Even this single quotation gives more support to my findings than to those of Sven Hedin, because the Chemayundung glaciers are east of and nearer to the Kanglung Kangri glaciers (the source of the Sutlej), whereas the Kubi Kangri glaciers (where Sven Hedin places the source of the Brahmaputra) are on the south-east of the Kanglung glaciers, and not on the east, as has been suggested by the Chinese professor. Taking the Tibetan traditions into account, we have a monument (called Tamchok Khambab Chorten in Tibetan) at the source of the Brahmaputra near the Chemayundung glaciers, shown to me by my Tibetan guide. There is a big boulder about 12 feet high, on the top of which are the footprints of a Buddhist deity, and over the footprints a small hut has been erected with loose stone walls and roof, with the horns of a wild yak placed on the top. Adjacent to the boulder are three *donkangs* (*dharmashalas*), of which one was roofed. My guide told me that the Nyakora tribe of nomads go over there for yak-hunting at the end of summer, as there are a good many wild yaks there.[1] All round the boulder there are hundreds of cairns.

Sven Hedin should have pondered over the meaning of the name "Tamchok Khambab": *ta*=horse, *amchok*=ears, *khambab*=mouth. So the literal trans-

[1] *Cf.* T. W. Webber, 'Forests of upper India' (London, 1902), chap. xi.

lation of the name Tamchok Khambab is "horse-ears-mouthed" river. The sources of the four Tibetan rivers are located by Tibetans in certain springs, to which they attribute the appearance of the mouths of various animals, just as the Hindus call the source of the Ganges "Cow mouth"—Gaumukh. There are two glaciers, called Chemayundung-phu and Tamchok Khambab Kangri, with a broad-faced peak separating them. The monument or the shrine is situated on the left bank of the Brahmaputra (where it is called Chemayundung Chu) between these two glaciers, opposite the broad-faced peak. The two glaciers are the two ears, and the boulder is the mouth. Both these glaciers put together go by the general name of Chemayundung-phu, or simply Chemayundung. The distance between these two glaciers is about 1½ or 2 miles. A little north or north-west of the Tamchok Khambab glacier is another smaller glacier or snow-field, behind which is the Angsi glacier.

Sven Hedin places the source of the Brahmaputra in the Kubi Kangri glaciers, giving us figures to show that the Kubi Tsangpo discharges more water than the Chemayundung. But he totally forgets this "theory of greater discharge of water" when he locates the source of the Indus. "'At this point the Singi Kampa is born. But the infant river which is a mere brook is shorter than either the Lungdep or Munjam.' 'The problem cannot be settled,' Sven Hedin writes, 'in any more satisfactory way than to accept the Tibetan view and to regard the Singi-Kabab as the source of the Indus in spite of its being the shortest and one of the smallest of the several source branches.'" [1]

If, as argued by Sven Hedin in fixing the source of the Brahmaputra, the quantity of water be taken into consideration, the source of the Sutlej must be placed not in the Kanglung glaciers (the source of the Tage) but somewhere in the Zaskar range. The Langchen Tsangpo, which joins the Sutlej a few miles below Tirthapuri, carries much more water than the Sutlej itself. This Langchen Tsangpo has three headwaters, two of which, the Guni Yankti and the Darma Yankti, are each bigger than the Tage Chu where it falls into Manasarowar. So the source of the Darma Yankti, which is somewhere near the Darma pass, should be the source of the Sutlej, as was remarked by Henry Strachey.[2] Surely the decisive point is that of the Tibetans and Chinese: that the two lakes, Manasarowar and Rakas Tal, lie on the Sutlej source stream like pearls on a string. When Rakas Tal is finally cut off from the Sutlej and its water begins to turn salt, then must the two lakes be regarded as an isolated hydrographic system.

"Some writers define the source of the river as the point of its course, that is most remote from its mouth. Colonel George Strahan has shown that if this definition be applied to the Ganges, its source will not be Himālayan at all, but will be near Mhow in Central India at the head of the Chambal." [3] In fact according to the Tibetan tradition the source of the Chemayundung is the source of the Brahmaputra, and the Chemayundung is the actual Brahmaputra; it is also longer than the Kubi. Whether length or traditions

[1] Burrard and Hayden, *op. cit.*, p. 241.
[2] *Journal* Asiatic Society of Bengal, 1848, p. 157.
[3] Burrard and Hayden, *op. cit.*, p. 184.

be taken into consideration, the source of the Brahmaputra cannot be placed in the Kubi glaciers, but must be placed in the Chemayundung glaciers. But if the source of the Brahmaputra be placed in the Kubi glaciers on the ground of the quantity of water, the location of the sources of the Indus and the Sutlej must be shifted elsewhere. If the sources of the rivers are to be fixed according to local traditions, as is done in the case of the Ganges and several other rivers, the source of the Brahmaputra should be shifted from Kubi to Chemayundung. Whichever theory be followed, Sven Hedin should not claim to be the discoverer of the sources of the Brahmaputra, the Indus, and the Sutlej. If any one wishes to verify my findings, I am ready to accompany him to the various sources of these three rivers. If any other theory but that of tradition be accepted in fixing the sources of these rivers, the sources of all the three rivers, the Sutlej, the Indus, and the Brahmaputra, must be shifted from their present positions as given by Sven Hedin and placed elsewhere after fresh exploration.

Besides the discussion about the sources of the three rivers, I would like to note down the following few points connected with the three great rivers, together with other information which may be of some use for future explorers.

*Ganga Chu* (*channel between Manasarowar and Rakas Tal*). When Sven Hedin visited Manasarowar he found "the highest point of Ganga Chu lying more than $6\frac{1}{2}$ feet above the level of the Manasarowar." There were heavy rains that year, yet he found that the bed of the Ganga Chu was dry. I crossed the Ganga Chu itself near Jiu (Chiu) Gompa, about 100 yards from Manasarowar on 4 September 1928. That year was exceptionally dry, and there were very few rains, yet the Ganga Chu was $3\frac{1}{2}$ feet deep and the flow was very rapid. I crossed it a second time on 21 August 1935, 2 miles from Rakas Tal. The current was gentle, but it was nearly 3 feet deep. I crossed it a third time half a mile from Manasarowar on 5 September 1937, and it was nearly $2\frac{1}{2}$ feet deep. I again crossed the Ganga Chu on six other occasions near Jiu Gompa early in the winter of 1937, when I was doing the circumambulation of the Holy Manasarowar. The stream of water $1\frac{1}{2}$ feet deep was frozen solid in the bed of the Ganga Chu. But near the hot springs (about 2 furlongs from Manasarowar) there was flowing water 6 inches deep. I followed closely the 6-mile winding course of the Ganga Chu along its left bank from Rakas Tal right up to Manasarowar on 14 April 1937, and I found ice and snow throughout the bed of the Ganga Chu, although at several places a regular slow flow of water towards Rakas Tal was seen. The water was very muddy where the Ganga Chu was flowing into Rakas Tal (Langak Tso of the Tibetans). I crossed the Ganga Chu again on 26 June and 17 July 1937, when there was flowing water about 10 inches deep. I crossed it again for the thirteenth time on 27 July 1937, and the water was about 16 inches deep.

There are sufficient grounds for believing that a rise in the level of the water of Manasarowar, and the consequent flow of water into Rakas Tal through the Ganga Chu, make the flow continuous into the now so-called "Old bed of the Sutlej" from Rakas Tal. The rise of water in Manasarowar and the consequent overflow into Rakas Tal through the Ganga Chu may be caused not

only by heavy rains but also by melting snows due to bright sunny days. I made circuits of Manasarowar, and found the Ganga Chu to be the only outlet of the lake.

Almost parallel to the Ganga Chu at a distance of about a mile on the south there is a line of gold diggings extending from Rakas Tal right up to Manasarowar. They were mined some years back, but nothing is done to-day. During the mining it was said that there had been an outbreak of smallpox, which was attributed by the Tibetans to the wrath of the presiding deity of the mines, and consequently the work was stopped. During the last operations, it was said one gold nugget as big as a dog (according to some, a dog-like nugget) was found.[1] At the place where that nugget was found, a *chorten* has been erected, which is called Serka-khiro (gold dog). This place is about a mile south of Jiu Gompa.

Some fifteen days' march northwards from the source of the Indus are the bigger goldfields at Thokjalung, Anglung, and elsewhere, which are being worked by the most primitive methods, scarcely worth the name of mining. About twenty years ago Tibetan gold was sold at Lhasa at the rate of Rs.10 per *tola*, according to the account given to me by the officiating Governor of Taklakot.

Tseti Tso, 3 miles away from Gussul Gompa, by the side of Manasarowar, has large deposits of borax both on the shores and on the island in it. The Tibetan Government has now stopped the working of borax there because of the belief that a deity became enraged. There are very big borax fields at Langmar and elsewhere in western Tibet.

*The Sutlej.* That part of the Sutlej described on the maps as "Old bed of the Sutlej" contained water, and there was continuous flow from Rakas Tal up to Lejandak, which is a day's march. I noticed it in August 1928, and also in August 1936. So the phrase "Old bed of the Sutlej" might be deleted from the Survey maps.

About 3 miles below Tirthapuri, a river called Langchen (by the same name as the Tirthapuri branch, coming from Rakas Tal) joins the Sutlej. When I asked my guide why this river was called Langchen, he told me that both this and the Rakas Tal branch go to make up the Langchen Khambab (the Sutlej), and so this branch also is called Langchen. This river Langchen is a combination of the three rivers Guni Yankti, Darma Yankti, and the Gyanyima branch. The Gyanyima branch carries much less water than the first two. Guni Yankti (called Chu Minjung in Tibetan) and the Darma Yankti (Chu Minjing) each carry more water than the Tage Chu where it falls into Manasarowar. Of these two rivers, the Darma Yankti carries the more water.[2] The Darma Yankti also carries more water than the Tirthapuri branch. So if the quantity of water is taken into account, the source of the Darma Yankti would be the source of the Sutlej; that is, in the Zaskar range somewhere near the Darma pass.

*The islands in Rakas Tal.* There are two islands in Rakas Tal: Lacheto and Dopserma (or Topserma). I visited them on 15 and 16 April 1937, when the lake was completely frozen. I traversed the frozen lake from east to west

[1] *Cf.* C. A. Sherring, 'Western Tibet' (London, 1906), p. 270.

[2] *Geogr. J.* 33 (1909) 427. So also Henry Strachey, *loc. cit.*, p. 157.

and from south to north on a yak. The island of Lacheto is shaped like a tortoise, with the neck stretched out towards a peninsula on the southern shore. The distance between the neck of the island and the cape of the peninsula is about half a mile. The circumference of the island is nearly a mile, and its surface is rocky and hilly. On the top of the hill there is a *laptche*, a heap of stones with *mani*-slabs, and on the western and the eastern sides of the hill there are the walled enclosures of the egg-collectors. There were wild geese on the level ground on the eastern side of the island. The egg-collectors of Kardam Goba were expected there in the last week of April, when the geese begin to lay eggs.

Dopserma, the southern part of which is named Tumuk, is rocky and hilly like Lacheto, but much bigger. The island is about a mile from east to west, and about three-quarters of a mile from north to south. On the eastern projection of the hill is a walled house in ruins, in which a Khampa Lama was said to have lived for seven years some time ago. Below the projection there are two or three walled enclosures. This island is under the jurisdiction of the Goba of Shungba. There were no aquatic birds on the island when I visited it. I could find only two islands in the Rakas Tal, and not three as shown in the maps of Sven Hedin or of the Survey.

*Freezing of Manasarowar and Rakas Tal.* The circumference of Manasarowar is about 54 miles. It froze on 28 December 1936 and melted again on 7 May 1937. It took three days to freeze completely, and the same number of days to unfreeze. Rakas Tal always freezes fifteen or twenty days earlier and melts again fifteen or twenty days later than its eastern neighbour, Manasarowar, but never earlier, as Sven Hedin states. The lakes freeze into opaque ice in the beginning, and then the ice becomes transparent. The thickness of the frozen ice in Manasarowar was 2–6 feet near the banks. Near the rocky banks the bottom of the lake, frozen fish, and water reeds could be seen through the transparent ice as if in an aquarium. The thickness of the ice on Rakas Tal appeared to be 2–4 feet. The peculiarity of Manasarowar is that there are tremendous cracks and fissures in the ice, whereas there are practically none in Rakas Tal. In Manasarowar terrible sounds are heard on occasion, and there are eruptions in the lake and along its shores. Nobody dares to go on Manasarowar when it is frozen, whereas men, flocks of sheep, loaded yaks and ponies traverse the frozen lake of Rakas Tal, as there are no cracks and fissures in it. On Manasarowar heavy blocks of ice of 20–50 cubic feet in volume are thrown by the eruptions 10 yards or so on to the shore. Sometimes the ice in the lake bursts and fountains of water gush out, forming small pools which are frozen again on the following night. The minimum temperature in winter 1937 was −18·5° F., and the lowest maximum was 2° F. Never was there a snowfall of more than 1½ feet on the southern shore of Manasarowar.

About a month after Manasarowar and all its feeders were frozen (with the exception of the Ding Tso and the mouth of Tage Chu), I found that the level of the water in the lake fell by about 12 inches below the ice, which consequently cracked and fissured. The disturbance beneath the ice due to the hot springs in the bed of the lake may also be the cause of cracks, noises, and fissures in Manasarowar. The absence of fissures in Rakas Tal may be

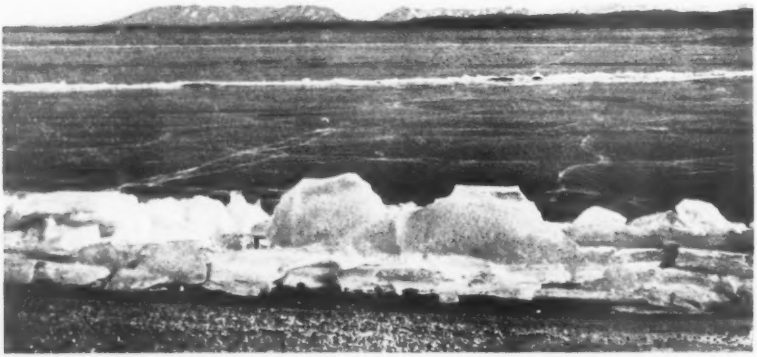
*Cairns and mani-stones at the source of the Indus*

*Chemayundung glacier at the source of the Brahmaputra*

*Mapcha Chungo spring forming the source of the Karnali*

*Kanglung Kangri glaciers at the source of the Sutlej*

*Unfissured ice of Rakas Tal, seen from Lacheto Island looking towards Dopserma*



*Manasarowar frozen, with fissures and rafted ice on the shore*

due to the fact that the water filtered out of it by subterranean paths is compensated by the subterranean supply from Manasarowar. As no appreciable vacancy is created beneath the ice on Rakas Tal, no heavy fissures are to be found in it.

*Hot springs of Manasarowar.* There are three hot springs on Ganga Chu, 2 furlongs from Manasarowar. One spring is on the left bank, one on the right bank, and one boiling spring on a small rock in the middle of Ganga Chu. About three-quarters of a mile south of the mouth of Ganga Chu, 40 or 50 yards from the shore, I saw an oval patch of water, about 10 yards in diameter, in the frozen lake of Manasarowar, on 28 January 1937, when the minimum night temperature in the verandah of my room was 2° F. Some aquatic birds were swimming and playing in the pool and on the ice nearby. This makes me believe that there must be hot springs in the bed of Manasarowar.[1]

About 3 or 4 miles from the shore of Manasarowar, upon the left bank of the Tage Chu, there are several hot springs at Tagpotong varying in range from lukewarm to boiling temperatures. There is a regular stream of hot water flowing into the Tage. Opposite these springs on the right bank of the Tage are some caves called Chuphuk, where a few monks live in winter. There are some *chortens* and *mani*-walls. Just near the caves there are the foundations of a ruined monastery. Some shepherds from Nonokur camp here in early spring and autumn for a couple of months in each season. Near the cave and a mile farther down there are more hot springs. About three-quarters of a mile above the caves, at a place called Tomomopo on the left bank of the Tage, there are hot springs, some boiling and bubbling and some lukewarm. It is interesting to note that there are hot springs at Tirthapuri and some at Kyunglung 10 miles down, on the banks of the Sutlej. Like beads on a string, there is a series of hot springs on the Sutlej, at Tomomopo, Tagpotong, Chuphuk, Iphuk, Manasarowar, Ganga Chu, Tirthapuri, and Kyunglung.

*Source of the Indus.* Of the different source streams of the Indus, the Tsethi Chu, the Lungdhep Chu, the Munjan Chu, and the Bokhar Chu, the Lungdhep Chu carries most water and is the longest of all the streams. I went to the source of the Indus by Lhe La and returned by Topchen La; therefore I did not see personally the Tsethi Chu, but my guide informed me that the Lungdhep Chu is bigger than the Tsethi Chu. Next come the Munjan and the Bokhar Chu, both of which appeared to be almost of the same size; some shepherds hold the Bokhar to be bigger than the Munjan, but my guide said that the Munjan is bigger than the Bokhar, and I cannot be definite about it. The Lungdhep Chu is certainly the biggest and the longest, and as such its source, which is in the Topchen La, should be considered the source of the Indus if the quantity of water is taken as criterion for fixing its source.

*Source of the Brahmaputra.* Of the three headwaters of the Brahmaputra, the Kubi, the Chemayundung, and the Mayum Chu, the Kubi is by far the biggest, and as such its source in the Kubi glaciers should be regarded as the source of the Brahmaputra if the quantity of the water is taken into

[1] Noted by Colonel Ryder in 1904.

account. But if length be the deciding factor, the Chemayundung branch, which is 6 or 7 miles longer than the Kubi (Sven Hedin admits this), should be the main branch of the Brahmaputra. The Kubi glaciers are nearly four days' march from the Chemayundung glaciers. Then again, Angsi Chu is longer than the Chemayundung, and the Angsi glaciers are equally massive. It seems therefore that we may have to shift the source of the Brahmaputra to the Angsi. The Indian merchants, who go from Manasarowar beyond the Kubi Tsangpo for wool purchases, consider the Tamlung Tso to be the source of the Brahmaputra, inasmuch as a stream from it flows into Angsi Chu and subsequently into the Chemayundung, which is considered by them to be the main stream of the Brahmaputra. As such the Indian merchants call the Tamlung Tso "Brahmakund," and consider it sacred and bathe in it.

*Source of the Map Chu, or Karnali.* After two days' march from Taklakot up the Karnali, I reached a place called Mapcha Chungo on the right bank of the Map Chu. At the edge of the bank is a big *mani*-wall with several *mani*-slabs and streamers. On descending a few yards towards the bed of the river I was shown the big spring of Mapcha Chungo (peacock mouth) gushing out from the wall of the steep bank of the river. There are some *mani*-stones and a few streamers near the spring. The water from the spring flows down a beautiful green velvety moss, which has some resemblance to the neck of a peacock, into the Karnali below. This spring is the traditional source of the Map Chu (peacock-mouthed river, or Karnali), and the actual source of the Map Chu or the Karnali is therefore somewhere near the Lampiya Dhura pass, whence flows the main stream of the Karnali.

*Conclusion.* Taking local Tibetan traditions into account, the source of the Sutlej lies in the Kanglung glaciers, east of Manasarowar, 65 miles from Barkha. The source of the Indus is in the springs of Senge Khambab (half a mile north of Bokhar Chu), north of Kailas, 53 miles from Barkha. The source of the Brahmaputra is in the Chemayundung glaciers, two days' march east of the Kanglung glaciers or 92 miles from Barkha, and the source of the Karnali is at the Mapcha Chungo spring, about 23 miles north-west of Taklakot. If one takes other facts into consideration, the sources of all the four rivers must be shifted elsewhere after systematic and scientific exploration and survey. I leave the matter for serious consideration to the seekers of truth, who may draw their own conclusions in the light of the few facts I can place before them.

*Note by T. G. Longstaff*

Sherring's 'Western Tibet' (1906) contains very apposite information on the Manasarowar problem. I would particularly draw attention to Sherring's panoramic photograph of the channel between Manasarowar and Rakas Tal on p. 271, a copy of which is in the Society's collection. In the *Journal* for February 1907 is a short paper by myself of which pp. 207 and 208 may usefully be compared with the Swami's interesting account. In general I am in full agreement with him in accepting the traditional sources of the four rivers. If length is to be the criterion, then further survey is required. If volume is taken as the test, then, with glacial sources and an Arctic winter

climate to contend with, flow must be measured throughout the year. It savours of impertinence for Europeans to assert their views against the usage of other civilizations.

I think that the cracking of the winter ice on Manasarowar and the "rafting" on the shore, shown in photographs sent by the Swami, indicate that there is active water-flow into Manasarowar even in the winter season. This goes far to justify the claim of the author that the true source of the Sutlej is in the Tage Chu, which flows from the Kanglung Kangri glaciers to the east of Manasarowar. Such water can only escape by the channel (the Ganga Chu of the Swami) at Jiu, connecting Manasarowar and Rakas Tal, thence to enter the "Old bed of the Sutlej" either above or below ground, according to the season. A flowing stream was found in this channel by Henry Strachey in 1846; by Sherring and myself in 1905; and by the author in 1928, 1935, and 1937.

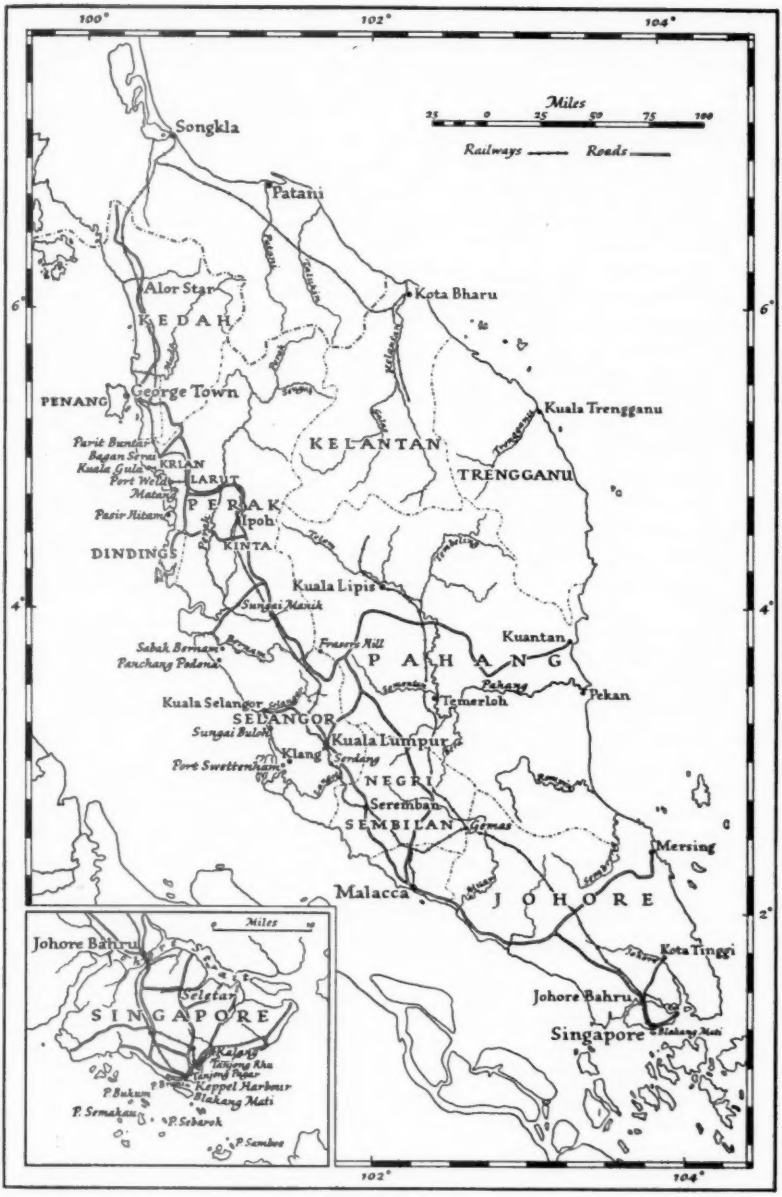
Those who have travelled in Tibet must admire the character of the Swami, displayed by his omission of all reference to the hardships he must have suffered during his winter journeys in these inhospitable regions.

# PLANTATION AND AGRICULTURE IN MALAYA, WITH NOTES ON THE TRADE OF SINGAPORE

A. W. KING

ONE of the outstanding features of agriculture in Malaya is unbalanced production, characterized by the extensive cultivation of crops for export markets, and the total inadequacy of the food-crops grown in the country to supply the local demand. Rubber occupies nearly two-thirds of the cultivated area and accounts for 90 per cent. of the value of the export trade in agricultural products. Malaya produces about 40 per cent. of her requirements of rice, the staple food of the people. Important export crops include coconuts, pineapples, oil palm, spices, areca-nuts, and tapioca. There is a large import trade in rice, coffee, tea, ground-nuts, sugar, tobacco, livestock, meat, dairy produce, poultry, and eggs. With the exception of the oil palm and the pineapple, crop production is mixed in character. The oil palm is grown exclusively in plantations. About two-thirds of the acreage under pineapples is now devoted to their sole cultivation. Rubber, coconuts, and other crops are grown under a variety of conditions: on large estates exceeding 100 acres in extent, on small estates which are owned mainly by Chinese, and in the typical Malay kampongs or smallholdings where rubber, coconuts, areca-nuts, gambier, and various fruits are intercultivated. The cultivation of rice under *sawah* conditions is the most persistent form of agriculture in the Malay kampongs. Catch-crops are cultivated with rubber, the oil palm, and other crops on newly established plantations so that there may be some return before the major crop comes into bearing about the sixth year; they include tapioca, pineapples, bananas, gambier, and *Coffea robusta*. The cultivation of catch-crops is decreasing owing to the dangers of soil erosion and to the cultivation of cover-crops.

Methods of soil conservation are commonly employed and include various forms of drainage and the cultivation of cover-crops. The more common forms include silt pits, contour terracing (or bunding), and contour drains. Silt pits or deep trenches about 15 feet in length are dug along the contours about 15 feet apart. The silt pits along a particular contour cover the gaps in the contour above, so that storm water and soil wash are checked. The ends of the silt pits on the several contours are sometimes linked by a zigzag system of bunds or ridges. Silt-pitting is now less popular than formerly, owing partly to the high costs of construction and maintenance. In contour terracing a succession of level terraces are constructed along the contours, the soil which is thrown on the downhill side being retained by a stone wall or reinforced by the cultivation of a dense cover. On some rubber estates drains are constructed along the contours in order to check storm wash. In Malaya such drainage methods are generally considered temporary expedients while cover-crops or plants which spread rapidly over the surface of the ground are established. The dense, low-growing cover-crop reduces weeding costs, checks rain wash, binds soil particles together, assists aeration and drainage by its rootlets, and improves the texture of the soil by the addition of humus. The cultivation of a cover-crop may deprive the main crop of certain essential




*British Malaya*

plant foods in the surface soil, and cover-crops are often planted in strips between the rows of the main crop, or an area round each plant is maintained in a clean condition. The several covers which are suited to particular conditions of soil, water supply, and shade include the creeping covers *Centrosema pubescens*, *Calopogonium mucunoides*, *Dolichos Hosei*, *Pueraria phaseoloides*, and *Mikania scandens*, and the bush covers *Lamtoro*, *Tephrosia candida*, and *Crotalaria anagyroides*. On some rubber estates where forestry methods have been adopted the natural covers or jungle plants are allowed to grow and are weeded selectively and controlled.

Animal husbandry in Malaya is insignificant. Dairy-farming is conducted on an extensive scale in Ceylon, Java, and Sumatra, but it is comparatively unimportant in Malaya. Experimental dairies have been established by the Government at Serdang and Frasers Hill, while the Singapore Cold Storage Company has large herds of Frisian cattle. These dairies produce the high-grade milk required by the European community, but the supply is inadequate. Malaya possesses no distinctive breed of domesticated cattle native to the country, most of the stock comprising Indian and Siamese breeds. Milk production is in the hands of Sikhs and Tamils, who maintain dairies in all the large towns. Pig-breeding is extensive, since pork is a staple item of the diet of the Chinese, the most numerous race in Malaya. The Malayan buffalo is essentially a swamp animal used in the cultivation of *sawahs* or rice-fields and occasionally for haulage purposes.

The major crops of Malaya are rubber, coconuts, rice, pineapples, and the oil palm.

*Rubber*. Malaya produces about 54 per cent. of the world's output of rubber. The major regions of production are located along the western lowlands where the West Coast Line and a network of roads have facilitated the alienation of land and the export of rubber. In contrast with Selangor and Negri Sembilan, there are large areas in Kelantan, Trengganu, Pahang, and Johore which lack communications and have not been alienated, though climatic conditions are suitable for plantation agriculture. About three-fifths of the total area under rubber comprises estates over 100 acres, of which Europeans control 82 per cent. of the acreage in the Federated Malay States, and over two-thirds of such estates in the Unfederated Malay States, principally Kedah and Johore. With few exceptions, areas under 100 acres are owned by Asiatics, who thereby control about 50 per cent. of the total area under rubber. Rubber is included in the mixed cultivations of the Malay kampongs.

The most important changes which have occurred in the rubber industry include the propagation of trees by bud-grafting in nurseries; the abandonment of clean weeding in favour of cover-crops and controlled jungle growths; the decreasing importance of daily tapping and the adoption of alternate-daily, A.B.C., A.B.C.D., and Sunderland systems; the restriction of output under the International Restriction Scheme; and the exportation of latex in bulk.

Experiments to improve the yield of rubber by bud-grafting and seed selection were first made by the Department of Agriculture in 1919. In a mixed stand of rubber trees it has been found by test tapping of young stock

that certain trees exhibit high yielding properties. Careful selection, cross-pollination, and test tapping have produced clones giving extremely high yields from which bud-grafts are taken for the bud-grafting of seedlings in the nursery. There is a greater variation in yield from seedlings than from budded trees of the same clone. Bud-grafting has become a common practice, since the yields from proved clones approach 1000 lb. per acre as compared with 300–500 lb. per acre from selected stock. The increasing yields of proved clones emphasize the value of the restriction scheme, which allows not more than 20 per cent. of the area of an estate to be replanted during the period of restriction.

In the establishment of a plantation the virgin jungle is felled and burnt at the end of a dry season, though large logs are sometimes valued in hilly country as temporary contour bunds. Contour terraces, contour drains, and silt pits are constructed to restrict soil erosion. Many Chinese smallholders cultivate bananas, ginger, ground-nuts, and soya beans as catch-crops, a practice less common than formerly. Clean weeding was the gospel of efficiency in estate management until the period 1925–30, when the consequences of soil erosion and deterioration became generally appreciated. To maintain the fertility of the soil and restrict soil wash, especially during the establishment of a plantation, cover-crops are grown in strips along the terraces or on the contour bunds. The abandonment of clean weeding during the slump resulted in the growth of jungle plants on many estates. The first aim of forestry methods is a partial reversion to the forest cycle, in which the fertility of the soil is regenerated and maintained by the growth of natural jungle covers, which are carefully weeded and controlled. On poor soils the pioneer jungle covers include bracken, stagmoss, and Straits rhododendron, which are slashed periodically. The consequent improvement in soil fertility assists the growth of secondary and other covers when the pioneer species are eliminated. Such forestry methods have not been widely adopted on estates, but there are indications that the planting practice of the future will involve the selective growth of natural covers.

The changes which have occurred in tapping systems have reduced the severity and frequency of tapping. The single and double herring-bone systems have changed to single cuts, either spiral or V, on one half of the circumference or smaller cuts on old trees. During the slump many double-cut systems, *i.e.* two cuts on opposite sides of the tree, were adopted in order to economize the time spent by tappers in walking from tree to tree. The frequency of tapping has changed from daily to alternate-daily, third-daily, A.B.C., A.B.C.D., and many other systems. The A.B.C. system, introduced in 1927, rests one-third of an estate for a certain period while the remaining two-thirds of the estate is tapped on alternate days. Double-cut systems, introduced from Ceylon, include the Sunderland and Double-four systems. The Double-four system consists of tapping two cuts on opposite sides of the tree every fourth day without any period of rest. Double-cut systems have not been adopted or retained on many estates. In July 1931, 72 per cent. of the area of estates in the Federated Malay States and Straits Settlements was tapped alternate-daily and 20 per cent. on A.B.C. systems. In December 1936, 32 per cent. of the area was tapped on alternate days and

60 per cent. on A.B.C. systems. The change from alternate-daily to A.B.C. systems is due in part to the slump and the restriction scheme.

The world crisis from 1930 to 1933, and the marked fall in the consumption of rubber, made restriction of world production necessary. Under the existing regulation scheme, which came into force on 1 June 1934, each producing country was assigned a quota, and the percentage of this quota which can be exported during any period is determined by the International Rubber Regulation Committee, whose headquarters are in London. The distribution of the quota among the producers of any country has been left entirely in the hands of the authorities in that country. The scheme has resulted in enhanced prices and the stabilization of the industry.

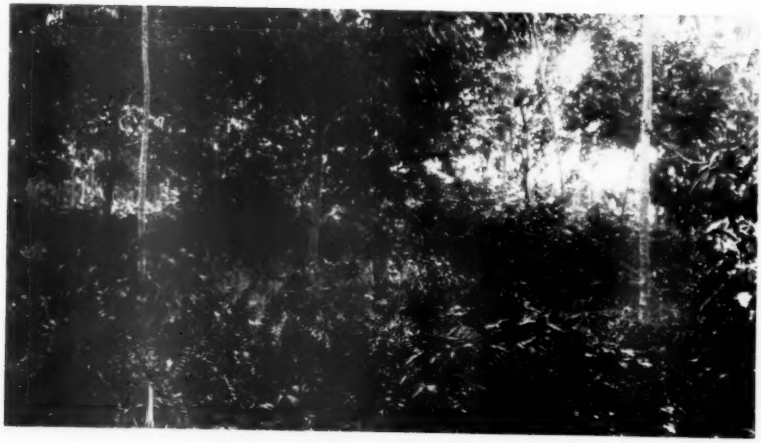
Smoke sheet forms the bulk of the rubber exports of Malaya, but there are certain new processes and types of manufacture for which latex is essential. It is now sent by tank-wagon to bulk installation plants at Port Swettenham and Singapore. Latex is also exported in drums to markets where the necessary unloading facilities do not exist.

*Rice.* Malaya produces only 40 per cent. of her consumption of rice, a circumstance due to the large number of immigrant labourers and traders who are more remuneratively employed in mining and plantation agriculture. Rice is grown under *sawah* conditions by the Malays who form the rural population of Malaya and produce sufficient for their own needs. The *per capita* consumption of rice is higher in Malaya than in any other country in the world. The yield per acre in the Krian district is only exceeded by one country. Isolated attempts have been made to cultivate two crops of padi during the year, but have met with little success. The critical factors include the cultivation of long-period maturation varieties; the necessity of using fertilizers when two crops are grown; and the impossibility of attempting cultivation either locally or irregularly, since the crop would be destroyed by rats and stem borers. The fallow season allows a convenient period for the repair of the *batas* or ridges defining the padi-fields. Mechanical cultivation has not been adopted owing partly to the small size of the holdings. In 1936–37 the area under wet padi was 693,550 acres, but there are vast opportunities for expansion, since the acreage of undeveloped potential padi land varies from 600,000 to 1,000,000 acres.[1]

Rice is grown under a variety of conditions: as wet rice on irrigated *sawahs* and as dry rice under *tenggala*, *ladang*, or *huma* cultivations when the growth of rice depends on rainfall. Along the western coast rice is generally planted in the long wet season which extends from September to January. In eastern Malaya planting takes place from July to September before the onset of the north-east monsoon. Fallow weeds are generally cut with a *tajak*, an implement somewhat like a short scythe, and cultivation is attempted with a wooden plough. Planting is done by women either by hand or with the aid of a *kuku kambing*, which obviates the prolonged stooping involved in hand planting. Simple methods of irrigation which are employed include temporary weirs of logs, bamboos, matted sticks, and earth; and miniature aqueducts formed of large bamboos and other trees. Harvesting is done with

[1] Report of the Rice Cultivation Committee, paras. 34–5.

*Nursery of rubber seedlings*



*Rubber plantation with dense natural cover*

*Sawah cultivation of rice*

*Coconut nursery and estate*

*Mangrove forest*

*Fishing village in the mangrove belt*

the aid of a simple knife known as a *tuai* or *pisau menuai*; the grain is trodden out and winnowed in a hand-machine or by allowing the grain to drop from a basket-sieve. In many districts the grain is cut with a scythe and the sheaves taken to a threshing *tong*, which consists of a short ladder inside a tub, against which the sheaves are beaten. Simple native methods of milling include the *kesaran* and various forms of *lesong* worked by hand, foot, or water power, in which the grain is pounded with a hard and heavy implement. The Government maintains rice-mills at Bagan Serai and Parit Buntar in Krian, and at Temerloh in Pahang. The large mills in Kedah, Province Wellesley, Penang, and North Perak are owned by Chinese.

The improvement and extension of padi areas under controlled irrigation schemes are due to the activities of the Drainage and Irrigation Department, which was established in 1932. The drainage and irrigation of existing padi areas has been improved, and land suitable for padi cultivation has been cleared and provided with efficient water control. The more important schemes under construction along the western coastlands include Krian, Sungei Manik in Lower Perak, and Sabak Bernam Peninsula, Panchang Pedena, and Sungei Buloh in Selangor. The additional area thus made available in the Federated Malay States, Penang, and Malacca at the end of 1937 was 40,209 acres. The colonization of newly developed padi areas has been restricted to Malays, and has been distinctly successful in the Sungei Manik area, where an area of kampong land has been reserved for colonists which is contiguous with the irrigated area, and the *bendangs* or holdings are 6 acres in extent. At one period the settlement of this area was affected by an invasion of elephants.

During recent years there has been a marked increase in yield per acre from 164 gallons (*gantangs*) in 1929–30 to 297 gallons in 1936–37. This increase may be attributed to work at experimental stations and test plots whereby strains suited to local conditions have been ascertained and the seed distributed to native cultivators; to manurial experiments conducted by the Department of Agriculture; to the more efficient water control of padi areas, the most critical factor affecting the yield of the crop; and to improved cultural methods adopted by the Malays consequent upon instruction and observation at padi stations and test plots.

*Pineapples.* Malaya is the second largest producer of pineapples in the world. In 1937, 72 per cent. of the total exports was consumed in Great Britain. The industry was established by Europeans in Singapore about 1888, but with the growth of the rubber industry cultivation extended to Johore and Selangor. The Chinese have been in exclusive control of the industry for many years. In Johore, which State accounts for about two-thirds of the acreage under pineapples, the main regions of cultivation are Gelang Patah, Kota Tinggi, and Johore Bahru. In Selangor the chief producing area is the Klang district. The varieties cultivated include Smooth Cayenne, Mauritius, and Queen types. Planting material generally consists of ratoons and suckers. The first crop is harvested about eighteen months after planting and two crops are harvested annually, in May, June, and July, and in January, February, and March. After the sixth year crops become less abundant and the fruit decreases in size, so that replanting is generally necessary. The

Chinese labour force is organized on the squatter system, and each family is responsible for about 15 acres.

Pineapples are grown as a catch-crop with young rubber, but the expansion of the export trade and the government ban on the alienation of land for rubber-planting has turned the attention of growers and canners to the cultivation of pineapples as a sole crop. The percentage of the total acreage devoted to pineapples as a sole crop has increased from 33 per cent. in 1933 to 65 per cent. in 1936. About one-sixth of the factories in Malaya own large plantations, but many canners in Johore have secured an interest in plantations in order to standardize the size and quality of the fruit.

The cultivation of pineapples as a sole crop led to closer planting, the growth of cover-crops to check soil erosion, and the use of fertilizers. Special conditions which include such details have been attached to the alienation of land in Johore for the cultivation of pineapples.

*Coconuts.* Malaya produces about 10 per cent. of the world's export of copra and 5 per cent. of the world's output of coconut oil. About 25 per cent. of the crop is consumed locally as food. Coconut products form the second most important agricultural export of the country.

The cultivation of coconuts on estates exceeding 100 acres is virtually confined to the Straits Settlements and Federated Malay States, where they occupy about one-third of the total area under that crop. In all parts of the country there are smallholdings of mixed cultivation and small coconut groves which satisfy local demands. The main regions of cultivation are the coastal lowlands, where drainage, or the movement of water through the soil due in part to the tide, is a critical factor. The coconut plants are transplanted from a nursery after six months, and the trees reach the bearing stage after the fourth year. The dwarf variety yields about twice as many nuts as the giant type and, in general, a larger quantity of copra per acre. The nuts are often transported by, or floated along, canals to the factory. Owing to the heavy and uniformly distributed rainfall the coconut meat or copra is generally kiln dried. The kiln is constructed of wood, stone, or bricks, and roofed with sheets of corrugated iron. Coconut shells are used as fuel for a small fire at ground-level, while the coconut meat is spread over strong wire netting at a height of about 10 feet. Much copra is spoilt through failure to maintain a uniform temperature or inadequate protection against winds. The establishment in country districts of the several types of kiln constructed at the Coconut Experiment Station, Klang, has improved the quality of the copra. Progress is hindered by the forward selling of nuts and copra by the Malays to Chinese dealers on a credit basis, which partly accounts for the indebtedness of the Malay *raiat*. The export of nuts is declining, but there is an increasing trade in copra of improved quality and in the more extensive manufacture of coconut oil, produced by simple methods in country districts as well as in factories at Klang, Penang, Singapore, and Kuala Selangor.

*Oil palm.* The pioneer oil-palm plantation was established in the Kuala Selangor district in 1917, but the cultivation of the crop did not extend very rapidly until about 1926. The *dura* type is widely grown on large estates in Johore, Perak, and Selangor. When plantations are established, cover-crops are generally grown to restrict soil erosion and maintain fertility; the cultiva-

tion of catch-crops such as tapioca, gambier, and bananas has therefore declined. The seedlings are raised in a nursery and transplanted after about nine months. The fruit bunches are borne in the axils of the leaves, and harvesting commences in the fourth year. Palm oil is obtained from the pericarp or outer pulpy layer and palm kernels from the inner nut. Palm oil was formerly exported in kerosene tins, barrels, and steel drums, but is now transported by tank-wagon and steamer to bulk installation plants at Singapore and Port Swettenham. In 1934 storage tanks were erected at Port Swettenham from which some oil was pumped direct into ocean liners; otherwise practically all of it is transported by tank-wagon along the F.M.S. Railways or by motor vessels from the Selangor and Bernam rivers to Singapore.

*Mangrove forests.* The mangrove forests of the Malay Peninsula cover 430 square miles, or nearly twice the area of Singapore Island. Along the eastern coast mangroves are confined to the estuaries of rivers and abandoned water-channels. The mangrove belt is almost unbroken along the western coast, and reaches a width of about 12 miles in the Matang mangrove near Port Weld, but extends farther inland along the estuaries of rivers.

The pioneer flora in the colonization of the coastal swamps consists of *Avicennia* (*api-api*) and *Sonneratia* (*perepat*,) the pneumatophores of which assist accretion and the establishment of the *Bruguieras* and *Rhizophoras* of the mangrove forest. In the interior of some islands such as Sangga there are patches of inland swamp forest which include Hutan Darat. The several species are markedly gregarious over large areas. The trees are about 70 feet high and resemble a sturdy pole crop. Progress is rendered difficult not only by the stilt roots and blind root suckers but by the great depth of mud, which necessitates a pathway of logs in most areas.

The Matang mangrove extends from Kuala Gula in the north to the former territory of the Dindings in the south. It is a vast tidal swamp, dissected by many shallow winding creeks which separate large islands such as Sangga, Gula, and Pasir Hitam from the mainland. Dennett has stated[1] that the origin of the western coast alluvial soils was due to the formation of a clay bund and the infilling of the lagoon thus formed by reeds, sedges, and other marsh vegetation. Along the coastal margin of the Matang the soil consists of a compact blue or grey clay with little organic matter. Inland brown mangrove loam occurs, which contains a high proportion of partly decomposed organic matter.

The local settlements consist of the fishing villages along the coast, which are inhabited almost entirely by Chinese contractors and their labourers, who are distributed in small lumber camps throughout the area; and by the Malay kampongs, which are located along the mainland boundary. The Chinese fishing villages are generally built on piles, the sea being shallow for some miles offshore. The dwellings consist of a framework of poles extracted from the mangrove forests, covered with the leaves of the *nipah* palm. Fish are caught in nets and traps and fed to pigs, which are generally housed with the Chinese themselves. At Sangga small fish are boiled in the preparation of *blachan*, a fish paste which is regarded as a delicacy in certain Eastern curries. The small village of Bagan Che'Akim also engages in duck-

[1] *Malayan Agricultural Journal*, June 1932, p. 299.

farming, while the village of Bagan Panchor in the south sends fish to markets in Ipoh. The monotony of their diet is occasionally relieved by rice obtained from Port Weld and elsewhere. Rainwater is sometimes filtered prior to consumption. The tide provides a means of sanitation for most of the settlements. In the midst of the filth and wretchedness of a village such as Sangga there is a church accommodating about thirty people.

Over 400 square miles of the total area of mangrove forests in the Peninsula have been constituted as reserved forests which are valued chiefly as a source of firewood. Exploitation is almost entirely in the hands of Chinese contractors. The head man or *kepala* is responsible for the construction of the temporary barracks, the excavation of extraction canals, the allocation of working areas among the coolies, who work independently, and sometimes for the provision of tools. The logs are generally carried to the stacking and splitting platform on the canal bank, where they are cut into firewood lengths and split with a heavy, blunt, wedge-shaped axe. Sampans are used for the conveyance of the wood from the sub-coupe to the railway siding or to junks which are used for transport in the open sea to Port Weld, whence it is sent inland by rail. Mangrove wood is still in great demand as a domestic fuel and on small steamers; the quantities consumed by tin mines and the F.M.S. Railways have shown a marked decrease in recent years. The mangrove trees make excellent charcoal, and there has been a marked extension of the industry in the Matang during recent years. The production of cutch from mangrove bark is under rigorous control. The Malay settlers along the mainland boundary, and the Chinese fishermen along the coast, have the right to extract timber for their own use. Some contractors market poles in the Larut, Kinta, and Penang districts. In general, mangrove trees are valued for piling and construction, while *nyireh* is used in the furniture industry.

The Malay settlements along the mainland boundary are engaged primarily in agriculture, with fishing as a seasonal occupation. Some Malays in the Matang mangrove belt engage in the hunting of crocodiles, a highly remunerative occupation.

*The trade of Singapore*

The island of Singapore is about 26 miles long and 4 miles wide, and may be compared in area with the Isle of Man or Middlesex. It is separated from the southern extremity of the Malay Peninsula by a strait about three-quarters of a mile in width, across which a causeway for road and rail has been built. The island is similar in shape to the Isle of Wight, and the positions of the port and naval base resemble those of Ventnor and Fishbourne.

From the Straits of Malacca vessels pass the islands of Blakang Mati and Pulo Brani, and reach the port of Singapore *via* Keppel Harbour. The Inner Harbour is protected from the north-east monsoon by a mole of granite rubble about 1 mile in length. Many vessels discharge and load cargo in the Inner and Outer Harbours by means of *tongkangs*, lighters, and *twakows*, which ply mainly to merchants' godowns along the Singapore river, to the Telok Ayer basin, and to free landing-places such as the Rochor river and Tanjong Rhu. The majority of ocean vessels are berthed at the wharves of the Singapore Harbour Board, which exceed 13,000 feet in length. Steamers

of 42,000 tons can approach the wharves at all stages of the tide. There are seven wharves and wet docks, including the Empire Dock, which is over 24 acres in extent. The facilities of the Harbour Board include five dry docks, of which the King's Dock is the largest. About 260,000 tons of cargo can be stored in godowns, which are linked with the F.M.S. Railways by about 17 miles of metre-gauge track. Large quantities of coal are stored on the Board's premises, while the Asiatic Petroleum Company supply fuel from their East Reclamation depot. There are six tanks and a drumming plant for the storage and export of palm oil in bulk, and latex is exported in bulk from the plant near the Main Wharf. Excise duties are levied on opium, alcoholic liquors, tobacco, and petroleum, but Singapore is a free port, the customs barrier being on the landward side of the causeway in Johore Bahru. Commerce is attracted to Singapore not only by its existence as a free port but by the exceptionally low charges of the Board, which offers free storage facilities for transhipment goods over extensive periods. There are no dock, port, harbour, town, or light dues.

The growth of the entrepôt trade of Singapore is due to its establishment as a free port by Sir Stamford Raffles in 1819. Within a few years it attracted a considerable junk trade with China and nearby countries, though this was somewhat harassed in early days by Malay piratical prahus. The growth of port facilities began with the conversion of a mangrove swamp into a port by the Tanjong Pagar Dock Company, Ltd., and the expropriation of the company by the Government of the Straits Settlements in 1905.

The port of Singapore, at the southern extremity of the mainland of Asia, dominates the great highway of commerce between the Indian and Pacific Oceans. Its commercial interests are far more extensive, for it is one of the world's entrepôts and commercial marts for the products of Europe, Africa, Australia, the Far East, and the western coasts of the Americas. In 1935, 13,595 merchant vessels, with a total tonnage of 30,255,426, were cleared at the port of Singapore. British vessels accounted for about a third of the total tonnage, while Dutch and Japanese vessels were together responsible for another third.

Statistics of the trade of Singapore do not indicate its full volume, as goods on through bills of lading are unrecorded and it is impossible to distinguish exports from re-exports in the official returns, made on a "pan-Malayan" basis. Considering gross values in the year 1935, Singapore accounted for 79 per cent. of the imports of the Straits Settlements and 72 per cent. of the imports of Malaya; and for 71 per cent. of the exports of the Straits Settlements and 57 per cent. of the exports of Malaya. The gross values of the import and export trade of Singapore in 1935 were $344,441,911 and $329,958,688. The Netherlands East Indies accounted for 39 per cent. of the imports and 10 per cent. of the exports of Singapore, while Sumatra alone contributed 24 per cent. of the import trade. The major imports from the Netherlands Indies include rubber, petroleum, sugar, copra, pepper, coffee, and areca-nuts, while the chief exports are rice, motor vehicles, cotton goods, fish, and petroleum. Nearly one-third of the export trade is conducted with the United States, the main articles of commerce being rubber and tin. Trade with Great Britain accounted for 11 per cent. of the exports and 14 per

cent. of the imports of Singapore. The principal imports from Great Britain are cigarettes, cotton goods, motor vehicles, condensed milk, tin plates, iron and steel goods, and machinery; while the main exports comprise rubber, tin, pepper, pineapples, copra, sago, and palm oil. Japan monopolized the import trade in cotton piece-goods, but exports such as rubber, tin, palm oil, and petroleum exceeded the import trade in value. Detailed statistics clearly indicate that Singapore is an assemblage port for the products of Malaya, Siam, Sarawak, British North Borneo, and the greater part of the Netherlands Indies; and a market centre from which the manufactured goods of more distant countries are distributed to those regions. Its functions as the chief port of Malaya and the transhipment centre of the Archipelago have allowed Singapore to acquire a world monopoly in two staples of commerce, tin and rubber.

There is a considerable import and export trade in petroleum and tin which requires further analysis. Through geographical position and its proximity to the oilfields of Sarawak, Sumatra, and Dutch Borneo, Singapore is the natural storage and distributing centre for mineral oils for the Far East, Africa, and Australasia. The islands of Pulo Samboe, Pulo Bukum, and Pulo Sebarok near the western entrance to the harbour form a major world centre for the petroleum industry. Pulo Bukum is within the Malayan registration area; the direct imports and exports of petroleum by the Asiatic Petroleum Company are therefore included in the trade returns for Malaya and Singapore. The tin-smelting industry of the colony has been fostered by a prohibitive duty on the export of tin in an unrefined state. The largest tin-smelting company in the world, refining about one-third of the world's output, has its works on Pulo Brani and Penang, and there are large works at Penang. Considerable quantities of tin ore from Siam, Burma, French Indo-China, and other countries are smelted at Singapore and Penang. Malaya produces about one-third of the world's output of tin ore and exports about one-half of the world's production of tin.

Many changes which have occurred during the last century have led to inquiries about the maintenance of the entrepôt trade of Singapore. These changes include the development of nearby countries which have attained a high degree of self-sufficiency, and have constructed ports suitable for ocean vessels; the extension of direct lines of ocean transport between these countries and the markets for their products; the growth of trading facilities such as through bills of lading, credit associations, and cable communications; and the industrialization of Japan, India, and China. In general, the trade of Singapore has shown an increasing concentration on the Netherlands Indies, especially on the island of Sumatra.

The prosperity of Singapore as a collecting and distributing centre for the Far East was first checked by the acquisition of Hongkong and the establishment of treaty ports in accordance with the Treaty of Nanking, 1842. The consequent extension of ocean transport to the markets of China was largely responsible for the decline of the Chinese junk trade with Singapore and the growth of the entrepôt trade of Hongkong. The percentage share of China and Hongkong in the trade of the Straits Settlements decreased from 10·6 per cent. to 6·3 per cent. in the import trade, and from 7·0 per cent. to 2·5 per

cent. in the export trade during the period 1902–33. The transhipment trade with French Indo-China has declined owing to the development of the port facilities of Saigon, the growth of direct services between Saigon and French ports, and the preferential rates on shipments in French vessels. Recent statistics [1] show a recovery since 1931 in the export trade of Singapore with French Indo-China. The government ban on the export of rice from the colony during the period 1919–21 resulted in the shipment of Siam and Saigon rice direct to Java, Macassar, Amboina, and the Celebes and Moluccas generally. The changes which have occurred in the trade between Siam and Singapore during the present century are comparatively insignificant and are partly related to the low prices which obtain for tin and rubber during slump periods. Exports to Singapore cover nearly one-third of the export trade [2] of Siam and include rice, tin ore, rubber, and fish. About one-seventh of the import trade is conducted with Singapore, the chief articles including cotton goods, petroleum, motor cars, cigarettes, coffee, sugar, and condensed milk.

The great development of the Netherlands Indies during the last sixty years may be attributed to the gradual abolition of the Cultuur System, the adoption of a virtual free trade policy in 1872, the opening of the Suez Canal, and the industry and enterprise of the Dutch. Contemporary with the economic development of the Netherlands Indies was the extension of commercial lines now controlled by Dutch companies. The growth of direct shipments was fostered by the construction of ocean wharves at Batavia, Sourabaya, Macassar, Telok Betong, Palembang, Pamanoekan, and Belawan, which has diminished the importance of Singapore as an entrepôt, especially for the varied produce of the eastern islands, which are economically tributary to Macassar, Batavia, and Sourabaya. The following table indicates the percentage share of Sumatra, Java, the Celebes and the Moluccas in the total import and export trade of the Netherlands Indies with Singapore:

| | *Imports into Singapore* | | *Exports* | |
|---|---|---|---|---|
| | 1901 | 1933 | 1901 | 1933 |
| Sumatra .. .. .. .. | 26·0 | 53·9 | 26·4 | 48·4 |
| Java .. .. .. .. | 19·4 | 14·3 | 38·6 | 29·7 |
| Celebes and Moluccas .. .. | 9·5 | 0·6 | 8·5 | 0·9 |

In general, Singapore has not maintained her former share in the import trade of the Netherlands Indies. The statistics of the export trade of the Netherlands Indies [3] indicate that the percentage share of Singapore has declined since 1925, while the details of the trade of the Straits Settlements show a considerable increase in imports from the Netherlands Indies during the last fifteen years. It should be observed that there was a fivefold increase in the commerce of the Netherlands Indies during the period 1900–28, so that

[1] Tableau du commerce extérieur de l'Indochine. Gouvernement Général de l'Indochine.

[2] See Statistical yearbooks of the Kingdom of Siam. Ministry of Economic Affairs, Bangkok.

[3] See Jaaroverzicht van den in- en uitvoer van Nederlandsch-Indië gedurende het jaaren 1927–35. Departement van Economische Zaken. Gedrukt door G. Kolff & Co., Batavia. Report of a commission appointed to inquire into the trade of the colony vol. 4, 1933–34. Government Printing Office, Singapore.

Singapore has shared to a considerable degree in the commercial development of the Netherlands Indies.

The Japanese share in the trade of Singapore has shown a marked increase during the last eight years. In 1935 Japan supplied 7 per cent. of the imports of Singapore and accounted for 12 per cent. of the export trade. Under the present quota system Japan controls about half of the cotton piece-goods trade of Malaya. The mercantile population of Singapore fear that the Japanese will soon dominate the shipping and banking interests of the colony. It has been stated [1] that 75 per cent. of the rubber trade between the East and New York is now in the hands of the Japanese.

Significant changes in the trade of Singapore include a marked decline in the exports of typical Straits products such as gambier, gum copal, rattans, pepper, tapioca, and jelutong. Such changes are due to a variety of circumstances: the deterioration in the quality of Singapore gambier; the decrease in the acreage under gambier, pepper, and tapioca in Malaya; the production of superior flake and pearl tapioca in Java; and the direct shipment of gum copal and rattans from Macassar.

*This paper is an abridged portion of a report submitted to the Board of Education after a tour of Malaya undertaken under government auspices and made possible by the award of a Board of Education Studentship. The photographs were lent by the Rubber Research Institute and the Department of Agriculture.*—ED. *G.J.*

[1] Straits Budget, 30 July 1936.

## SURVEY AND GEOLOGY OF NORTHERN LABRADOR

NORTHERNMOST LABRADOR MAPPED FROM THE AIR. By ALEXANDER FORBES, with contributions by O. M. MILLER, N. E. ODELL, and ERNST C. ABBE. *New York: American Geographical Society (Special Publication No. 22), 1938. 10×7½ inches; xx+256 pages; illustrations and maps. Also separate case, containing "Navigational notes," four-sheet map (1 : 100,000), and two other maps (1 : 300,000).* $4.00

THIS is an account of a series of expeditions; a detailed account of northern Labrador; and a valuable addition to the series of Special Publications issued by the American Geographical Society. The work it describes was inspired, led, and financially supported by Dr. Alexander Forbes, whose normal field of activity is the School of Physiology at Harvard, of which he is Professor, and whose hobbies include an active interest in sailing, navigation, geography, aviation, and photography. Such a man had only to meet Sir Wilfred Grenfell to be led into a Labrador expedition, and as soon as he realized how little was known of northern Labrador, the simple plan for a summer vacation cruise developed into a scheme for a major survey with aeroplanes and a well-found ship. The American Geographical Society took up the scheme and lent Mr. O. M. Miller, the head of their survey school. Later the generosity of members of the Society's Council made possible the printing of the handsome map sheets which accompany this publication.

Before this expedition only a quarter of the eastern coast of Labrador had been charted adequately; this southern section has been revised by H.M.S. *Challenger* during the years 1932–34. Charting the Labrador coast is a task of exceptional difficulty, as rocks and dangers to navigation extend in extraordinary profusion to distances as great as 50 miles from a coast which is itself highly indented and cut up into islands and narrow channels. The bottom is continuously rugged; ice and fog restrict the working season to a few months. This makes the first attempt to map this coast by air survey of exceptional interest. It is no reflection on the zeal of the officers and ship's company of H.M.S. *Challenger* to say that three seasons of survey by conventional methods produced results small by comparison with the labour and expense incurred. A complicated coast, although it demands much labour in the essential coastal mapping, does offer some compensation in providing numerous points from which the position of craft engaged in sounding may be resected. If a ship can begin the truly hydrographical survey with a map on the scale of, say, 1 : 75,000 prepared by air photography, the sounding can be carried out rapidly and triangulation is necessary only for specially detailed plans of channels and anchorages.

The aim of Dr. Forbes's expeditions was to produce an adequate topographical map of the mainland, supplemented by as much hydrography as possible on routes likely to be used by craft working along the coast. To carry out this scheme an aeroplane would obtain strips of oblique aerial photographs, and a ground party working from the supporting ship would provide as much ground control as possible. Dr. Forbes was fortunate to obtain a Banks type schooner, 97 feet overall, with a 110-h.p. auxiliary motor. She carried a Fairchild aeroplane with a 420-h.p. Wasp engine and a smaller Waco plane. Mr. Odell was invited to join the ship as a geologist and Mr. Abbe as botanist.

The main expedition took place in 1931, when the air survey was made of the region between Nachvak fjord in 59° N. and Cape Chidley, the northernmost point of Labrador. In 1932 photography was extended southwards and in 1935 certain gaps in the photography of 1931 were filled. The northern portion,

all that has so far been plotted, has given about 4000 square miles of survey at 1 : 100,000. The whole of this area was covered in about twenty hours of flying time.

The difficulties of the Labrador coast are fogs, shoals, and gales. Frequently when entering the skerry-strewn channels the boat had to be sent ahead with a specially devised sweep to indicate any submerged rock to a certain depth within a fairly wide path. During the summer, periods of four or five days of good weather alternate with similar periods of rain or fog. The ice varies much; in 1932, when Greenland was remarkably ice-free, the Labrador pack was heavy as far south as 56°, off Nain.

Mr. Miller's account of the mapping is an interesting essay, most agreeably written, on the use of high obliques in aerial survey. The country, with mountains rising to about 5000 feet from a highly indented coast, is ideal for survey by oblique air photographs. The problem is how to plot them.

Mr. Miller began with a technique recalling that devised by Captain Crone, R.E., and described in 'Hints to travellers,' vol. II. But experience of graphical methods led him very early to conclusions which he states thus: "Before the expedition started in 1931 I realized that if we were going to complete an extensive mapping programme it would be essential to speed up the work of resection and plotting by measuring angles directly from the photographs instead of making linear measurements on the photographs and converting these into angles." He continues in another place: "It is possible to extract horizontal and vertical angles from a photograph by making rectangular coordinate measurements with a straight edge and an accurately divided scale. This however involves either a certain amount of computing or else very carefully made graphical constructions."

These graphical constructions are tedious and awkward to make. If they have to be made by expensive labour it would be essential for most survey offices to seize any chance of using a mechanical solution of the problem. The point has been clearly made by Professor Schermerhorn in a paper delivered at the International Geographical Congress—"Aerial photogrammetry and geography" (*Photogrammetria* No. 1, 1938). The American Geographical Society first of all made a photogoniometer (*Bild-Theodolit*) on a somewhat novel principle, and very soon afterwards developed a single-eyepiece plotting instrument using a familiar optical device which had not previously been used in such instruments. With the second instrument resections can be made very quickly, and once the orientation is determined coast-lines can be plotted continuously and height differences to fixed points determined without computation. The logical development, to make a double-eyepiece plotter on the same principle, is, we believe, already well advanced.

The important point made by the American Geographical Society is that the machine is simply a mechanism for accelerating operations which can be done by rulers and pencils backed by a calculating machine. Time and energy freed by the use of the plotter have been given to the problem of the extension of control and the development of a technique of mathematical analysis for the determination of the orientation of the photographs. The probability is that in its turn this part of the work will at some future date be taken over by the double-eyepiece plotter.

The accuracy claimed is equivalent to measuring directions to one minute of arc. Actually Mr. Miller had only twenty-five ground points for his entire area; he completed his sheets at the rate of about 850 square kilometres per man per year, which is a lower rate than that attained by the Danish Geodetic Institute in mapping East Greenland by stereoscopic machinery.

This work indicates how future surveys of such coasts may well be undertaken. Rigorous triangulation will probably never be carried out in such regions, and charting will perhaps be based on air surveys. Already the Danish Hydrographic Department (Søkortarkivet) is doing its own photography and plotting. There are many desolate coasts like that of the Labrador which would be amenable to these methods. If for example the growth of Darwin as a port causes an increase in traffic along the Queensland Coast by the Inner Route, demanding an improvement of the charts of the Great Barrier Reef region, air survey might well provide an alternative to triangulation amongst reefs.

M. A. S.

*Note on the geology*

Mr. N. E. Odell has made no attempt to describe the region in full geological detail, but he has succeeded in giving a stimulating and lucid account within the limits he has set himself: "to say something of the geological facts to which the scenery and topographical features of the country are due." The country is indeed of considerable interest, for out of the whole area of the Canadian Shield only in Labrador are there areas of relief which merit the name of mountains. This is ascribed primarily to a marked relative upwarping of the region in late Tertiary times.

The rocks of northern Labrador are all assigned to the Pre-Cambrian. The earliest Archaean gneisses and schists have evidently undergone deep-seated regional metamorphism. The Ramah series are distinguished as less radically altered sediments, to which may be related a distinctive group of horizontally disposed volcanic rocks found in the Kaumajet mountains. Dyke rocks in the Torngat mountains are specially mentioned, for they include such uncommon types as hypersthenite, charnockite, and anorthosite. Crustal stresses early imposed on this region an approximately N.N.W.–S.S.E. grain. The original folds have long since been denuded, and in the present mountains it is only the roots of the folds which are to be seen. The latter part of Mr. Odell's contribution deals with the period when the main features of the present topography were sculptured, namely in late-glacial and post-glacial times. There is evidence of no more than one principal glacial advance in northern Labrador, but Mr. Odell has found reason to believe that then the ice submerged even the higher mountains as an unbroken continental ice-sheet. As soon as the ice began to recede, a cycle of mountain glaciation was initiated, and the imposing effects wrought during the successive stages of this cycle are clearly described.

The photographs, and in particular the numerous aerial views, interspersed throughout the book, form admirable illustrations for Mr. Odell's text. A somewhat condensed account of his paper has been published in *Science Progress* for January 1939 under the title "The present landscape of northern Labrador in relation to its geological history."

W. L. S. F.

# THE DISTRIBUTION OF RURAL SETTLEMENTS

THE International Geographical Union has had in being for the last twenty years an active committee on rural habitat, which has stimulated research in many countries. The results have appeared in its reports to the last five congresses, and in many journals. Those presented to the last two congresses occupy respectively 142 and 168 pages of the transactions of the section on human geography.[1] Besides these numerous articles there is the volume 'L'habitat rural en Belgique' by Mlle M. A. Lefévre (1926), which is both a notable contribution to the study and a source of inspiration for many subsequent workers, and some earlier works, in particular that of Meitzen.[2] At the Warsaw Congress, Z. Góralówna summarized a bibliography of works on rural habitat published up to the end of 1933; the total was then 748, and many more have appeared and been recorded, either in full, in abstract, or by reference, in the publications of the Congress or elsewhere. Of this total of about a thousand studies half have been made within the last twenty years, and the bibliography is probably not exhaustive.

The most widespread evidence of the human occupation of the earth is the modification of the surface of the land made by past and present generations of rural workers in agriculture, in pastoral husbandry, and in tree culture and exploitation for both fruits and forest products. The marks of these essentially rural occupations form by far the greater part of the cultural landscape of human geography, which man has superposed on the natural landscape of physical geography. More or less prominent among the visible and relatively permanent facts of the rural landscape are the building, or buildings, of the farmsteads, housing the population, forming storeplaces for materials and tools, and often sheltering the animals. This rural habitat is much more than the residence of the farmer and his family; it is also a chief tool of his trade, which has been developed in relation to his work and adapted to the existing type of rural economy. Hence it and its distribution have been the principal topic of research. M. A. Demangeon, a leading worker in this field and an inspirer of many students, has termed this habitat "un outil adapté au travail du paysan."[3] This concept had led to studies of the form and arrangement of the buildings as well as of their distribution; but the basic contributions are those which describe and map the actual distribution of the rural habitat in specific areas, and show that distribution both as a fact in itself and in its areal relations to other geographical facts, such as relief and altitude, water supply and drainage, soils and underlying rocks, dominant crops and types of cultivation, roads and other means of communication, density and distribution of population in the area, and, sometimes, political boundaries. In some cases it has been possible to do this for past periods, as in the mapping of the Doomsday Survey in England and of the prehistoric settlements in Sardinia. Though records of past distributions are almost always incomplete, where they are available it may be possible to trace some stages in the evolution of the rural settlement in the area.

In the actual distribution of rural habitat two characteristic types, with many

[1] Reports of the Commission de l'Habitat Rural presented to the congresses of 1925, Cairo; 1928, Cambridge; 1931, Paris; 1934, Warsaw; and 1938, Amsterdam. *Comptes Rendus*, Warsaw, vol. 3, section iii, pp. 401–543. *Comptes Rendus*, Amsterdam, vol. 2, section A, pp. 1–168.

[2] A. Meitzen, 'Siedelung und Agrarwesen der Westgermanen und Ostgermanen, der Kelten, der Römer, der Finnen und der Slawen.' Berlin, 1895.

[3] *Annales de Géographie*, 1920, p. 353.

intermediate stages, can be discerned. In many areas the habitats are all, or nearly all, grouped into compact villages or large hamlets; so that the rural settlement is concentrated or agglomerated. At the other extreme are areas in which the majority of the farmers or peasants dwell on their own lands, scattered over the township or commune. In such a township there may be no village, and only very few buildings clustered together where the church and school, the inn, and a general shop or store stand near a convenient road focus. This is the scattered or dispersed habitat.[1] But these extreme types are rare to-day, and more commonly the township contains a village and a varying number of scattered habitations, some of which may be grouped into hamlets. In such an intermediate type of settlement the relative proportions of concentrated and dispersed population may vary widely. It may result from either a spread outwards over its area of colonists from the concentrated nucleus or the partial clustering round a central focus of a formerly scattered population. It could also result from the settlement of immigrants among an already established rural population. There is some evidence of all three of these developments.

In one of the earliest of the well-known works on this topic, Meitzen,[2] as his title indicates, ascribed the different types of rural settlement, both in distribution of habitat and in characteristic plan of village, to racial or ethnic factors. He found Germanic, Keltic, and Slavic settlement types. Later work has completely destroyed this hypothetical explanation of the differences which exist. Scattered settlement, or dispersed habitat, is not confined to people of any one racial type; it is found among peoples of all the chief racial types known in Europe. It is clear that the plan of a village, or the distribution of farm lands and buildings, is not a function of race; nor are these things associated with linguistic distributions. Contrasting types are frequently to be found in the same country.

In semi-arid regions, as in southern Tunis, permanent settlement clearly depends on water supply; and the population generally dwells in compact villages or small towns whose site is determined by the accessibility of reliable supplies of water. But in humid lands it is usually possible for the peasant to obtain sufficient water for man and beast almost anywhere. Hence in lands of adequate rainfall the local water supply is not often the decisive fact in the siting of the habitations. It appears to be true that a large and well-distributed rainfall, as in Ireland and Brittany, is often associated with dispersed habitat; but the connection is probably through the type of rural economy rather than direct.

In areas where there is only a small proportion of cultivable land, chiefly in scattered patches, agricultural settlements are necessarily limited to the good lands, and are thus dispersed. This dispersion is characteristic of some mountainous lands, such as Norway and the Alps; and also of some morainic belts in drift-covered lowlands. Yet it seems that it is only in these marginal cases of poverty of water or of cultivable land that such purely natural factors are decisive in rural distributions. Over most of the inhabited lands rural distribution shows little or no direct dependence on such factors.

Instances of change of distribution in a given area are well established. Archaeological survey, based on air photography,[3] has established the fact that there was a widespread agriculture on the chalklands of southern England, probably lasting from late Neolithic to early Iron Age times, which divided the

[1] See the sketch of the distribution of these types by A. Demangeon in the report of the Committee to the Congress of 1928 (pp. 41–80).

[2] Meitzen, *op. cit.*

[3] See, for example, 'Wessex from the air,' O. G. S. Crawford. Oxford, 1928.

land into compact enclosed fields. But the agricultural land of medieval England was worked on the openfield system, in which the land of a village was held in common and the arable was redistributed among the peasants at short intervals, usually annually, while the whole was used as common pasture from harvest to spring. The openfield was associated with concentrated habitat, for the peasants lived in a compact village. These openfields disappeared in the enclosures from the sixteenth to the nineteenth centuries, and the rural landscape changed to our present familiar one of compact fields enclosed by hedges and hedgerow trees, with scattered farmsteads, each in its own land. This is in its turn now giving way in some areas to a more open scene of large fields, suitable to mechanized agriculture; and there the traditional character of our landscape of the last two or three centuries is again disappearing.

Similar changes have taken place in northern France and parts of central Europe. But it seems significant that in France the openfield system, with its strip cultivation and common pasture, did not become so dominant in the southern and western parts of the country. It is suggested that the difference may have been due largely to simpler cereal cultivation—a rotation of wheat, barley or oats, and fallow—combined with pastoral husbandry, in these lands during the Middle Ages. In the south tree culture was much more prominent in the ordinary rural work; in particular the edible chestnut supplied a large part of the food of both men and animals; and tree culture is not easily adaptable to a frequent redistribution of the cultivated land. A dependence on long-lived plants is usually associated with a system of permanent holdings.[1]

The choice of annuals or perennials as the staple crops of cultivation is undoubtedly influenced by climatic facts which limit the possible range of any plant. It is also affected by the degree of social security, and by the level of skill in agriculture. In turn the dominant crop influences the work and organization of the people and their land tenure, and so the form and distribution of the rural habitat. The destruction of a crop of wheat affects only one season; when the destroyer has passed the peasant can prepare for a harvest next year. But the destruction of an orchard or a chestnut grove cannot be repaired in less than ten or twenty years, or of an olive grove in fifty. Hence one effect of a period of insecurity, such as that which followed on the collapse of the Roman Empire, was to increase the area and importance of the annual plants on which the relatively simple economy of the openfield system depended, at the expense of the more varied and elaborate cultivation of a wider range of plants. The change led to an impoverishment of the regions, with a decline in the numbers and prosperity of their peoples. The openfield system also facilitated the grouping of the rural population into compact villages, where they were more fully under the control of the lord to whom they looked for protection. It is probable that the openfield system, with its scattered strip cultivation and periodic redistribution of the arable land among the peasants, its common pasture, and its concentrated habitat, which long dominated, and still influences, the pattern of rural settlement over much of Europe, is the product of a particular type of social organization and its associated rural economy rather of any specific racial or physical facts.

An article on Sardinia, by M. Lannou,[2] records a very marked change in that island from the dispersed settlement of later prehistoric time—from five

[1] Compare the influence of the introduction of commercial cocoa cultivation on land tenure in the Gold Coast. See W. H. Barker, in *J. Manchester G.S.* 37–8 (1924) 167, 168.

[2] *Comptes Rendus* of the Congress of 1938, pp. 101–6.

thousand to six thousand such settlements are known from existing remains of their stone buildings, the *nuraghi*—to the concentrated habitat of the present day, with only some 350 compact and generally large villages.[1] In the period from the fall of Rome to the thirteenth century there was here a system of communal agriculture with compulsory rotations, like that of the openfield system of Europe north of the Alps; though such a system is not well suited to the more characteristic crops of a Mediterranean climate. For many centuries the search for security was the dominating fact in the life of the people, and it determined their modes of habitat, of land distribution, and of agriculture.

In North America the settlement of the lands west of the Appalachians in the later decades of the nineteenth century was mostly carried out under the homestead system, which virtually imposed the dispersed type of habitat, since each homesteader must build on his farm. But in Latin America the hacienda is often a compact settlement where all the workers of a large estate, comparable with a township, live near to one another. Here a different social system and different land laws have produced the alternative concentrated rural habitat.

Several writers draw attention to a widespread tendency towards the loosening out of the compact settlement. This is often associated with the distribution of the cultivated land into many small parcels, either held permanently or redistributed at every year or few years. Such a fragmentation of the land is wasteful in many ways. It still exists in many parts of Europe; but most European Governments have, during the present century, pursued a policy of consolidation of such scattered holdings. The expropriation of great landlords and the distribution of the land among the peasants, which followed the establishment of new States east of the Baltic and the break-up of the Austrian Empire, were accompanied by such a consolidation; so that the peasant ceased to be a tenant cultivating several fragments and became the owner of a small compact farm. In such cases there has been a gradual move towards dispersed settlement. On the other hand the extreme dispersion of habitat on the prairies of North America has caused a lack of centres of social life and organization which has led to a movement for the development of community centres there, often focusing round the school, an indication of a slight reversal of the trend towards extreme dispersion.

Some explanations suggested (*e.g.* by Meitzen) on the base of a narrower range of studies and *a priori* reasoning have been proved wide of the truth by the work of these later investigators. As the result of their studies it may be said that while physical facts, such as those of climate, relief, and soil, set limits to the extension and character of the rural landscape, these limits are usually wide; and within them the differences are determined by man himself. Within the limits of the physically possible the type and distribution of habitat is mainly dependent on the type of rural economy and the stage of its development. C. B. F.

[1] Compare similar concentration in Corsica, which has 364 communes. See article "Corsica" by C. B. Fawcett in the *Sociological Review*, 1930, pp. 72–82.

# REVIEWS

## EUROPE

BRITAIN IN RECOVERY. Prepared by a research committee of the Economic Science and Statistics Section of the British Association. *London: Sir Isaac Pitman and Sons*, 1938. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xvi + 474 *pages; diagrams.* 15*s*

This is a sequel to the earlier volume published under the title of 'Britain in depression,' and the two make a valuable contribution to the study of a trade cycle. But the later volume, although following the general plan of its predecessor, devotes more space to general topics and less to individual industries. Geographers will find much useful material here collected in a handy form; and as the purpose of the book is to record rather than to interpret the history of the recovery, there is opportunity for them to follow up many of the points here made in outline.

In a short notice it is impossible to touch on all the facts which are of geographical significance. Of particular interest is the chapter on the electrical industry. It showed itself largely immune to the effects of the depression for reasons which are set out at length, and it is now of great national importance, employing nearly half a million persons in 1937. How rapid has been its rise may be judged from the fact that production of electricity doubled between 1931 and 1937. As about one-third of the generation of electricity takes place in south-east and east England, this new development is likely to continue to play an important part in the changing location of industry.

Equally interesting is the motor industry. There were about 18,000 motor vehicles on the roads of Britain in 1904; in 1937 the number had risen to nearly 3,000,000. A valuable section shows how the rise of this industry has had far reaching effects, and it is claimed that "there is no other industry to-day, except perhaps shipbuilding, which consumes so wide a diversity of raw materials and basic products."

Some interesting light is thrown on the operation of the Ottawa agreements, and one cannot escape the conclusion that a more thorough knowledge of the economic geography of the Empire would have supplied the answers to some of the questions there raised. As for the results, "the British Dominions and Colonies gained in their trade with Britain at the expense of foreign countries," and "the gain in Britain's exports to Commonwealth countries was smaller than the increase in her imports from those countries."

The volume as a whole suggests that there is a great opportunity for geographers to take an active part in the direction of policy. One illustration of this must suffice. An important factor in the change from depression to recovery was the expansion of the building industry, helped by the growth of London and other large towns and by the increase in working population in the south of England. This fact will hardly escape the notice of those who wish to plan in advance against the next depression, and in that event the advice of the geographer might be worth much.

This volume has been produced by a research committee of Section F (Economics) of the British Association. It suffers from the defects of a compilation by many authors, but it undoubtedly supplies a useful set of data for the study of contemporary Britain, and it is much to be hoped that the sales of this work will encourage the authors to add to this excellent "fragment of recent history."

J. N. L. B.

COMPANION INTO ESSEX. By HERBERT W. TOMPKINS. *London: Methuen and Co.*, 1938. 7½×5 *inches;* xviii+268 *pages; illustrations.* 7*s* 6*d*

Mr. Tompkins deals chiefly with the literary and historical associations of Essex, but in many instances he depicts these skilfully against the geographical background of a county whose landscape, though at one time commonly referred to as "flat and uninteresting," is full of fascination. He says of Epping Forest that few districts of like size have produced genius so freely, a fact which he attributes in no small measure to its beauty. References are made to existing remains of certain famous oaks celebrated in literature, including the Fairmead and Fairlop oaks in Epping Forest, and the Doodle oak in the Hatfield Forest tract not far from the village of Hatfield Broad Oak or Hatfield Regis. In the account of the Blackwater estuary we are reminded that the Reverend S. Baring-Gould in his tale 'Mehalah' has left us a powerful description, rich in local colour, of the desolate salt marshes of which Essex contains large tracts. The description of the Stour valley and the Constable country brings before us the local setting of certain famous pictures, such as "Flatford Mill," "Dedham Mill," "The Hay Wain," and "The Glebe Farm." As regards the last-named there is no hint at all of the uncertainty which seems to exist as to the position of the farm, which is simply stated to stand near Langham church. The number of celebrities associated with Essex either by birth or residence is large, and it may be of interest to note that Purchas was born at Thaxted, Spurgeon at Kelvedon, and Gilbert the magnetician at Colchester. In a book of modest compass on so large a county the reader will not expect an account of every village or even town; but in view of the emphasis laid by the author on the attractiveness of Essex place-names it is surprising to find a short description of High Easter, in the heart of rural Essex, 8 miles north-west of Chelmsford, unaccompanied by even a reference to its somewhat smaller neighbour Good Easter, about 2 miles distant. The interesting Roding villages are mentioned as a depressing example of declining population through the drift of people to the industrial regions, which is occurring in Essex on a wider scale than in any other county and is actually threatening some villages with extinction.

L. C. W. B.

PYRENEAN: being the adventures of Miles Walker on his journey from the Mediterranean to the Atlantic. By J. B. MORTON. *London: Longmans, Green and Co.*, 1938. 9×5½ *inches;* 212 *pages; frontispiece.* 8*s* 6*d*

This is the account of a zigzag journey on foot through the Pyrenees, from the Mediterranean to the Atlantic, at a time not recent but not otherwise indicated. The book is a fragment of autobiography, important to those interested in Mr. Morton, the Pyrenean, rather than to those interested in the Pyrenees. Mr. Morton rarely attempts to bring the mountains before the mind's eye. They are there, but like the scenery in an Elizabethan play: the occasion is the thing. The tone throughout is that of provocative irony, with a flattering wink now and then at the sophisticated reader and a good deal of allusion to earlier strenuous performances in the Pyrenees which are never related in full. But weather and food are in sharp focus.

M. A.

THE STRUGGLE FOR THE DANUBE, AND THE LITTLE ENTENTE, 1929–38. By ROBERT MACHRAY. *London: George Allen and Unwin*, 1938. 9×5½ *inches;* 344 *pages; sketch-map and portraits.* 12*s* 6*d*

In a previous work on the Little Entente Mr. Machray described its origins and development from 1919 to 1928; he now carries its history down to May 1938. 1929 was an important year for the Little Entente, for the conference

then held in Belgrade provided it with a permanent organization which was further developed during the economic crisis of the ensuing years. Mr. Machray is obviously sympathetic towards the Succession States, but he writes objectively and provides a fluent, straightforward statement of facts (with occasional slips due to hasty proof-reading) which enables the reader to test his own theories and draw the conclusions. The Little Entente deserves careful consideration as a one-time basis for a Danube federation. Mr. Machray deals with other schemes for the attainment of that end, proposed in good faith by other European Powers but too ambitious to succeed (such as Briand's "United States of Europe"); his account also shows how the Little Entente failed through the narrowness of the basis on which it was organized, and through its lack of dynamism and adaptability. Despite the genuine desire of many of the statesmen connected with it to restore normal conditions in the Danube basin, the Little Entente remained little more than an instrument to preserve the *status quo*. Yugoslavia and Romania were agricultural countries; Czechoslovakia was partly agricultural, partly industrial. The exchange of goods between the three was but one-tenth (in 1936) of their total transactions with foreign countries. The usefulness of the Little Entente was thus limited, and Mr. Machray brings out clearly how one opportunity after another for enlarging its scope, through the inclusion of Austria and Hungary, was lost, partly through the jealous intervention of other Powers.

The bibliography suggests that much of the material has been taken from communiqués and other official sources, and this, though the range is wide, may account for a certain complacency in tone and phraseology. J. P. H. M.

UNGARNS LANDWIRTSCHAFTSGEOGRAPHISCHE GESTALTUNG. By ARNO WINKLER. (Ungarische Bibliothek. Edited for the Ungarische Institut an der Universität Berlin by JULIUS VON FARKAS. 2. Reihe, 8.) *Berlin: W. de Gruyter and Co.*, 1938. 10½×7 *inches;* vi+152 *pages; illustrations, maps, and diagrams. RM.*5

The conscientious student will be able to derive from this little book many useful facts about the economic geography of Hungarian agriculture, though much of the material is already available in a book on the same subject by various Hungarian authorities, also written in German, and published in 1937.

The author aims at a "dinglich-räumlich-zeitliche" survey of the distribution of the crops and livestock of Hungary, and prefaces his analysis by accounts of the climate, soils, peoples, size of holdings, river regulation, and development of the railways. In the fairly long section on climate, stress is very rightly laid on the variability of the Hungarian climate, as this aspect of the continental type of climate is apt to be forgotten by people living in west European lands. The section on soils, based mainly on Treitz's well-known work, is also clear, but little use of this is made in discussing the distribution of the crops; for instance, in the section on wheat the author ignores the concentration of this crop on the loess soils of the Alföld, which is usually taken by geographers to be a significant correlation. The bald statement that the importance of wheat in the southern and eastern Alföld was due to the presence of German and Romanian immigrants surely needs considerable evidence in support before the point can be considered proven. Also the increase in the wheat acreage on the sandy soils of the Pest-Pilis Comitat between 1895 and 1928 may be due to many causes at whose existence the author has not even hinted. In fact, for the survey to have real value, another series of statistics needs interpolating between the years 1895 and 1928, say 1910, so that the economic results of the 1919 frontiers could be studied.

A very full bibliography is appended, mainly of German works, and a number of maps show the changes in distribution of the most important crops and animals in the years 1870, 1895, and 1928. M. R. M.

SOVIET TRADE AND DISTRIBUTION. By LEONARD E. HUBBARD. *London: Macmillan and Co.*, 1938. 9×5½ *inches;* xiv+380 *pages.* 12*s* 6*d*

Despite the immense number of books on Russia which have appeared in the last few years, few deal even superficially with the economic geography of the country. The present book is no exception: it is an economic analysis which "is based on principle, particularly in regard to planning, and must not be accepted as an accurate description of what is done in practice . . . how different are Plan and Practice." Within these rigid limits there is a wealth of impartial information. L. D. S.

## ASIA

SEEN IN THE HADHRAMAUT. By FREYA STARK. *London: John Murray*, 1938. 10×7 *inches;* xxiv+200 *pages; illustrations and sketch-map.* 21*s*

This volume contains a selection of Miss Stark's magnificent photographs taken on her recent journey in 1938 to the Hadhramaut. They are most artistically reproduced in photogravure, in sepia monochrome, and the interleaves, on which there are full descriptions of the plates, are also in pale sepia tint. At first sight there seems to be no particular arrangement of the collection, but Miss Stark has evidently preferred to group them by subjects rather than in the order in which they were taken, though she has not kept strictly to groups. In general she has dealt with the scenery, but more particularly with the great buildings in the towns, their many-storeyed mansions, their architectural grouping and decoration, the features of their walls, battlements, doors, and windows, the people, their customs and their occupations. It is impossible to select the best of a superb collection for special mention, or to praise too highly the skill of the photographer or the artistic sense displayed in their reproduction. As the author says in her foreword, "These pictures preserve in some measure what may soon be only a memory of the past, for these houses, decorated by leisure and created for defence, have no place in the modern world."

In an altogether too brief foreword Miss Stark however underrates what her admirers require from her pen. She admits that, but for her publisher, she would have left us with less than two pages of letterpress. The lively and most interesting introduction fully justifies Mr. Murray's insistence; in fact it is perhaps a pity that he did not carry his importunity a little further and beg a list of illustrations or table of contents. K. M.

WATER SUPPLIES IN 'IRAQ. By W. A. MACFADYEN. ('Iraq Geological Department. Publication No. 1.) *Baghdad: Government Press, for Ministry of Economics and Communications*, 1938. 13×8½ *inches;* 206+viii *pages; maps and diagrams.* 250 *Fils* (5*s*)

This is a collection of sixteen separate reports on water supply at various localities in 'Iraq, made since 1933 by the Government Geologist. To them has been added an introduction which includes a summary of geology as related to water supply, rainfall tables, and a short description of *kehariz*, or infiltration tunnels. The several maps germane to the reports themselves have been augmented by five others of general application, the most important being a valuable, albeit provisional, geological map of 'Iraq, scale 1/2M, and a rainfall map, nine-year mean, 1928–36. A well-arranged index has also been included. These reports, naturally varying considerably in length and importance, include

an account of present resources, geological information, rainfall statistics, over two hundred analyses of water with critical remarks, a suggested programme for future development, and an abstract of previous literature.

Mr. Macfadyen has assembled a mass of information of great geological and geographical interest. The material of an official publication is usually, and of necessity, subject to limitations of treatment, but such limitations have not impaired an excellent picture of present-day conditions of water supply in 'Iraq, both overground and underground. When one learns that in some cases the daily supply of water available per head at the present time is only 3 gallons (in England the daily consumption is about 12 gallons per head in country districts, and 40–50 gallons in large towns) one is inclined to envy Mr. Macfadyen the opportunity of his constructive and beneficial work.

As might be expected, most difficulties of water supply in 'Iraq are shown to be due to lack of rainfall, and it is interesting to find, in one report, confirmation of a view that in the southern desert there is no true water-table, but only a number of supplies of local accumulation. But difficulties other than lack of rainfall are shown to exist; some for example of geological origin, as in the Wadian country, where the outcrops of Cretaceous and Eocene limestones give rise to karst conditions, and some political, as in the Zarbatiya neighbourhood.

One wishes that the general description of the *kehariz* could have been expanded. The author states that these tunnels were constructed as follows: A well is sunk by hand, digging to the water-table, on rising ground. Thence a tunnel is driven with such gentle inclination that while water will run down it the slope is less than that of the surface of the ground and of the water-table. A series of wells for access, to remove debris while digging, occur at intervals of 15–25 metres. Some of these tunnels are several kilometres long. The brief description given in the volume raises several points for speculation. Since the slope of the tunnel is less than the water-table, the bottom of the first well may be expected to be below the water-table. Did men work in several feet of water, or were the *kehariz* constructed at a time when the water-table was at its lowest (in which case the yield during dry weather would be very small)? Methods of surveying and levelling appear to have been of no mean order to bring the tunnels out at the required spot and level. As most of these apparent difficulties could be avoided if tunnelling were commenced at the exit end, why was this method not adopted?

The draughtsmanship of the maps and diagrams does not do justice to the excellence of the rest of the volume; the frontispiece (Plate III) is particularly crude. Maps in some cases, for example Plates VII and VIII, require a lens to decipher the place-names, although each name is surrounded by a desert of blank paper. F. H. E.

THE GATEWAY TO INDIA: the story of Methwold and Bombay. By A. R. INGRAM. *London: Oxford University Press*, 1938. 9×5½ *inches;* xxx+192 *pages; illustrations and maps.* 7*s* 6*d*

Among the servants of the East India Company who helped to build up its fortunes during the first half-century of its existence the name of William Methwold must be given a prominent place. In the opinion of Sir W. Foster, Methwold stood, alike in character and ability, head and shoulders above both his immediate predecessors and his colleagues. Mr. Ingram now gives us an interesting account of his career as well as of the events of his time, leading up to the cession of Bombay to Charles II in 1661 and its subsequent transfer to the Company in 1668. The story exemplifies graphically the many difficulties with which the Company had to contend in the early days of its operations:

the risks of navigating small craft in uncharted and storm-swept seas; the heavy mortality among its employees, due to climatic and other causes, and the misconduct of some; the rivalry of the Portuguese and Dutch, often breaking into open conflict; the interference of "interlopers"; the obstruction and hostility of the local powers.

Methwold reached India, after an adventurous voyage, in 1616. His first two years were passed at Surat, Tiku in Sumatra, and Bantam in Java. He was next deputed to Masulipatam as "Principal of the coast of Coromandel." There he performed his duties with skill and success, managing to keep on good terms with the Dutch, who were already established on that coast, and with whom friction occurred elsewhere, culminating in the "massacre of Amboina." Indeed it was with two Dutch officials that he made his expedition to the Kollur diamond mines, the "Relation" of which was printed by Purchas. Charges of private trading being made against him, he decided, though exonerated by the Council in Java, to which Masulipatam was then subordinate, to go to London, where he remained for nearly ten years until his appointment in 1633 as President at Surat. Here, under most trying conditions, he piloted the Company's affairs with conspicuous ability during six critical years, and effected an important pact with the Portuguese which was destined to bear good fruit. It was then also that he conceived the project of securing a defensible station at Bombay, where the harbour would afford a safe roadstead for ships—a "castle in the aire," as he expressed it, which materialized later, and under Gerald Aungier expanded into the foundation of the city of Bombay; hence the title of this book. Returning to England in 1639, he was made Deputy-Governor in 1640. In this position, which he continued to hold until his death in 1653, he helped by his character and experience to protect the interests of the Company at a period of grave political unrest.

Some further personal details about Methwold have been given in Moreland's 'Relations of Golconda' (Hakluyt Society, 1931), to which reference is not made. Nor does Mr. Ingram appear to have known of another Hakluyt Society volume, 'The voyage of Thomas Best to the E. Indies,' by Sir W. Foster; otherwise some errors in the introduction might have been avoided. For instance, Thomas (not William) Aldworth went out with Best in 1612, after W. Hawkins had left India (p. xviii), and it was through Best's exertions that he was established at Surat. Best however never had an interview with the Great Mogul (p. xxii). Sir H. Middleton did not return to England (p. xx) after his last fateful voyage; he died at Bantam. The story that Best inaugurated a naval defence force at Swally (p. xxii) must be regarded as unfounded. The illustration facing p. 11 shows the Dutch (not the English) factory at Surat: how the mistake in identification arose has been explained in *J.R.A.S.*, October 1933, p. 911. The main narrative shows much solid research. C. E. A. W. O.

A COMPENDIUM OF THE EAST: being an account of voyages to the Grand Indies, made by the Sieur Jean de Lacombe, of Querçy . . . in an English translation by STEPHANIE and DENIS CLARK. Edited by ASHLEY GIBSON. *London: The Golden Cockerel Press*, 1937. 13 × 7½ *inches;* 208 *pages; illustrations and maps.* £3 3*s*

That a detailed story of eight years' travel in the Far East in the seventeenth century, by an author showing some powers of observation, should have remained unknown until a fortunate chance put the MS. into the hands of the present editor might seem so unlikely as to suggest a doubt as to its genuineness. Even without questioning the date claimed for it, one might ask whether it gave the writer's own experiences or whether it might not be a mere compilation.

The editor himself has felt that its credentials must be carefully examined, which he has done by research and inquiry, not slurring over any points which might arouse suspicion, and it must be confessed that the results are as satisfactory as could be hoped for.

The MS. was picked up in Paris in 1937, and it soon proved that its interest was greater than might have been expected. Little could be learnt of its history, but a few jottings on the endpapers and elsewhere supplied helpful clues, particularly a minute inscription above the title, "Ex MS. Walckenaer," evidently referring to the French baron of that name, well known as a geographer and writer of the first half of last century. In the same handwriting, apparently the baron's own, there are a couple of references to other works (both known to have been in Walckenaer's library) and a number of corrections to the original text, probably made with a view to publication. The writer, Jean de Lacombe, has been hitherto unknown to fame, and the editor has so far learnt nothing about him beyond what he tells himself—that he was born in Quercy (Dordogne), probably about 1640; that he served the French king as a soldier for twelve years; and that being forced to leave his country he visited England and made voyages to Canada and Brazil, afterwards putting in further military service in Flanders. While interned at Flushing he entered the service of the Dutch East India Company, and sailed for Java in the *Losdune* in 1668. His varied experiences during this service are described in the present narrative.

Mr. Gibson's inquiries in Lacombe's home district have not yet yielded any facts about the man himself, but they established the importance of the family of that name in the region centring in Quercy. Inquiries in Holland show that a vessel named *Loosduynen* sailed for the East on the very date mentioned by the traveller, arriving in Java in 1669. He places his own arrival there more than a year later, but there is other reason for thinking that he changed ships *en route*, making a stay of some length at the Cape. Certain items in the story which seemed open to suspicion have proved rather to vouch for his truth: thus his account of his rather fantastic adventure on "La montagne d'Adam," in Ceylon, which could not fit in at all with Adam's Peak, is justified by the fact that the name Adam's Berg was applied by the Dutch to the crag Mulkirigala, in quite a different locality, and that here can be seen the big statues spoken of by the journalist. The inscription copied by Lacombe in a cave on the mountain was no fake, for certain of the characters have been identified by experts with those of Eastern scripts.

Traces of exaggeration or inaccuracy are no doubt to be found, for example in the description of the Ceylon tigers, and of the monstrous sea-cow. Lacombe was greatly interested in the plants and animals of the countries visited, which included China, and in the manners of their inhabitants. His account of one of the big elephant drives in Ceylon appears to be the earliest, in any detail, that we have from an eye-witness. He had some reason to complain of his treatment by his employers, but he had a high opinion of their administration, though his general outlook remained essentially French.

There can be little question that the story was worth printing, which has been done in an attractive form, involving unfortunately a high price for the volume. One may ask whether the subject-matter was really worthy of such a setting. Points in the narrative are elucidated by a modest number of notes, and there is a useful bibliography. It is a pity perhaps that in certain cases reprints or translations rather than the original editions have been entered. This applies for example to the French and German translations of the original Dutch narrative of Wouter Schouten, which are entered separately, with no indication that Schouten and Schultzen were one and the same person. One

is surprised also to find no reference to the noted German traveller Kaempfer, with whose Eastern travels those of Lacombe show some analogy, though the Frenchman could not of course claim the scientific competence of the German. Two of Mercator's maps are reproduced as endpapers, but their description as "contemporary" is hardly correct, as they were made more than sixty years before Lacombe started on his travels. Two pages of the clearly written MS., one showing corrections attributed to Walckenaer, are also reproduced. E. H.

THE SPIRIT OF INDIA. By W. J. GRANT. *London: B. T. Batsford, Ltd.*, 1938. 9×6 *inches;* viii+120 *pages; illustrations and sketch-maps.* 10*s* 6*d*

"India has a soul choice and individual. My object in this book is to give that soul wings." So writes the author in his preface; and he has certainly taken flights in several directions, expressing his thoughts in forcible, and at times racy, language.

Mr. Grant presents a brief survey of India, her life and problems. He appears to have studied the religious and philosophical concepts of Hinduism, if not deeply, at all events with an unprejudiced, even sympathetic, mind. He objects to such expressions as the "problem of India," the "mystery of the East," and to what he calls "our sublimest delusion," that India is backward, as being due to misconception of facts. He has little but praise for Hinduism, and thinks she is "defiling her hands" by adopting the Council-entry programme, "like a prayer meeting learning to dance the hornpipe" (p. 92). Many of his sentiments will not be accepted by persons who have had a longer experience and deeper acquaintance with the people and their culture. In the course of an otherwise generally sound discussion of the value of the caste system, one is rather surprised to read an inexact explanation of the terms "exogamy" and "hypergamy."

The book is accompanied by 141 reproductions of excellent photographs of Indian scenery, architecture, and human types, but these would seem to have been collected from independent sources with the idea of illustrating the text, in which reference is not made to them. In regard to these it may be noted that Fig. 2 is a Jain, not Hindu, statue; Fig. 5 shows a Brahmani bull, not a cow; while Fig. 102 is unlikely to be a representation of the Buddha.

C. E. A. W. O.

IMPRESSIONS OF AN INDIAN CIVIL SERVANT. By R. D. MACLEOD. *London: H. F. and G. Witherby*, 1938. 9×5½ *inches;* 234 *pages; illustrations.* 10*s* 6*d*

The territorial unit of administration in British India is the "district," and the executive control thereof vests in the District Officer, who is ordinarily a member of the covenanted civil service. Two books about that service, chiefly from the historical and general points of view, have been published in recent years. The present volume has been written from a different standpoint, namely that of the District Officer, "the backbone of the administration" as he has justly been called. Mr. Macleod, most of whose service was spent in district work, reveals the inner working of the machine, giving a graphic yet detailed account of life and work in a representative district of northern India. We see the District Officer, whether at headquarters or on tour, ever in close contact with the people, performing the multifarious duties—revenue, magisterial, police, excise, etc.—of his charge, when visiting the jail, hospital, schools, and various local institutions, even when inspecting his own offices. The description is true to life. Mr. Macleod then pictures to us the European's personal life in an Indian "station," by no means minimizing its many drawbacks, and goes on to discuss, with inside knowledge and much shrewd comment,

several aspects of Indian politics and some problems that call urgently for solution. He is least happy perhaps in his chapter on "The Indian mentality." We are unable to agree with him that "there is no word for 'thanks' in Urdu" (p. 195); and his definition of *Nāgarī* as "a cumbrous kind of script akin to Sanskrit" (p. 227) must shock any reader who knows Sanskrit or Hindi.

The illustrations, which have been well selected, are all appropriate to the narrative. C. E. A. W. O.

THE SILK ROAD. By SVEN HEDIN. Translated from the Swedish by F. H. LYON. *London: George Routledge and Sons*, 1938. 9×5½ *inches;* viii+322 *pages; illustrations and map.* 18*s*

The Sino-Swedish expeditions, organized and led by Sven Hedin, have since the War spent years exploring with camel caravans the Gobi desert and the heart of Chinese Turkistan. In 1933 Dr. Hedin was once again in China, winding up the affairs and records of his explorations. By a fortunate coincidence he was able to interest the Chinese Government in the possibilities of motor transport between China and Chinese Turkistan; and it thus came about that he was commissioned by the Chinese Ministry of Railways to lead a motor-truck expedition into Turkistan.

Equipped with a small caravan of Ford cars and trucks the party left Peiping in the autumn of 1933, returning fifteen months later in the early part of 1935. Unfortunately the arrival of the expedition in Chinese Turkistan synchronized with the Muhammadan rebellion led by Ma Chung-ying, when the greater part of Sinkiang was thrown for many months into a state of frightful anarchy and civil war. The expedition found itself immersed in a turmoil of warring factions, Tungan, Turki, Russian, and Chinese. But, in spite of almost ceaseless incident and misadventure, much useful exploration was accomplished. On his return to Sweden Dr. Hedin wrote his trilogy of travel: 'Big horse's flight,' dealing with the Muhammadan rebellion and the expedition's adventures and encounters with the rebels; 'The wandering lake,' describing the exploration of the region round Lop Nor; and the present volume, giving an account of the further experiences of the expedition and of the route followed, including portions of the old Silk Road, the historic trail which once linked China with Europe overland. The theme of the book turns on the possibility of the development for modern transport of this ancient road.

The outward journey was made by the Inner Mongol route, and across the Black Gobi to Hami and Turfan. This motor trail, known nowadays to the Chinese as the Sin–Sui (Sinkiang–Suiyuan) highway, from Suiyuan (Kweihwa-ch'eng) to Hami, had been discovered by the Swedish Söderbom brothers and others, Chinese and Mongols, interested in the development of motor transport between China and Turkistan. Beyond Turfan the expedition became seriously embroiled with the retreating Tungan host, as related in greater detail in 'Big horse's flight,' and were obliged to abandon their project of reaching Kashgar with their motor caravan. The circumstances of the civil war turned however to their advantage when they were diverted southward from Korla, in order that they might not see too much of what was going on, because this enabled Dr. Hedin to carry out the most interesting portions of the expedition's work, the exploration of the Lop Nor region and the branches of the old Silk Road which used to run along its shores.

The troubles of the expedition were still far from at an end. Compelled by shortage of oil and petrol to pay a visit to Urumchi, Dr. Hedin was detained for many months in the sinister capital of Chinese Turkistan. The author gives an entertaining account of life in Urumchi in the year 1934 and picturesque

details of its extraordinary conditions and no less extraordinary personalities, Russian and Chinese. Freed at last from the clutches of Urumchi (with its evil reputation for detaining indefinitely all foreign visitors), Dr. Hedin returned to China by the old Imperial Highway, the Silk Road, through Anhsi, Kansu, and Shensi to Sian. An interesting chapter is devoted to the history, and possibilities for modern motor transport, of this most ancient of Asiatic roads.

In an appendix Dr. Hedin discusses subsequent political developments in Sinkiang, and mentions reports which have reached him that the Silk Road is now in running order as a trans-Asiatic motor route for the transport of supplies from Chuguchak to China.

The book is full of incident, but its construction is confused, and it is difficult to disentangle the expedition's work and geographical activities from the picturesque descriptions of incidents and personalities. The photographic illustrations are admirable, and there is a good index and an excellent map. E. T.

DISCOVERING CHINA. By O. M. GREEN. *London: Sir Isaac Pitman and Sons*, [1938]. $7\frac{1}{2} \times 5$ *inches;* viii + 104 *pages; illustrations and map.* 1*s* 9*d*

This is a brief picture of a journey to Hongkong, Canton, and other southern ports, and then to Shanghai and up the Yangtze to Nanking, Hankow, and Chungking, with a divergence to Changsha. Then we are taken north to Tsingtau and Wei-hai-wei, and on to Tientsin and Peiping. The concluding chapters deal briefly (and apparently at second-hand) with the outlying regions of Sinkiang, Kansu, Yunnan, and Mongolia.

The descriptions are readable, and often vivid, and the author obviously has a liking for the Chinese. Sometimes his atmosphere appears to be rather out of date. The references to history are inevitably jejune, and confined to well-known events and conventional interpretations of them. Buddhism and Confucianism are briefly touched on, but there is no mention of Taoism. It must be said that one cannot really "discover" much about China without some understanding of that intriguing and all-pervasive philosophy and its influence on Chinese character and outlook. Nevertheless the author has done well with the space at his disposal. A. S. E.-S.

IN KOREAN WILDS AND VILLAGES. By STEN BERGMAN. Translated by FREDERIC WHYTE. *London: Travel Book Club*, 1938. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 232 *pages; illustrations and map.* 3*s* 6*d*

This is a valuable addition to the bibliography of Korea. As befits a scientist, Mr. Bergman adopts an objective method in presenting his subject, and his work should appeal to the naturalist and the traveller alike. The purpose of his travels in Korea was essentially zoological; he gives us the results of his work in this sphere and describes the journeys which he made in search of specimens. In the course of those journeys, which it is clear must have called for considerable endurance on the part of the author and his companions, he acquired a considerable amount of knowledge regarding the life and customs of a little-known land, so that his work is doubly informative. The photographs with which it is illustrated are excellent, and Mr. Whyte's translation is thoroughly readable. E. H. DE B.

HISTORY OF BAALBEK. By MICHEL M. ALOUF. Fifteenth edition. *Beirut: American Press*, 1938. $8 \times 5\frac{1}{2}$ *inches;* x + 128 *pages; illustrations, map, and plans*

Those who have had the good fortune to be conducted over the ruins at Baalbek by the author of this excellent guide-book will know how much devoted labour has been put into its compilation. M. Alouf was Curator of the Antiquities of

Baalbek from 1897 to 1934, and the first edition of his book appeared in 1890. Many of the archaeological discoveries at Baalbek during the last fifty years were made by M. Alouf, and it is in no small measure due to him that much-needed repairs and restorations have been undertaken by the Government.

The first part of the book describes Baalbek and its neighbourhood; the second deals with the magnificent ruins, and includes the latest investigations into their origin and purpose. L. B.

## AFRICA

GEOLOGIE AFRIKAS. (Geologie der Erde. Edited by E. KRENKEL.) Dritter Teil, zweite Hälfte (Schluss des Werkes). By ERICH KRENKEL. *Berlin: Borntraeger*, 1938. 10½×7 *inches;* viii+1305–1918 *pages; profiles and maps. M.*54

This concluding part of the 'Geology of Africa' deals with the portion of the continent north-west of a line from Calabar to the Mediterranean coast north of Siwa Oasis. It is divided into three great regions: Guinea-Sudan, Sahara, and "Nordafrika" (the Atlas region, north-west of a line from Agadir to Gabes). This last region, though the smallest, is the most explored, and its description takes up most of the book.

Unlike west-central Africa, the subject of the preceding part (reviewed in the *Journal* for December 1935), north-west Africa contains fossiliferous strata of nearly every period, even areas far inland being covered by Cretaceous and Eocene marine deposits. Pre-Cambrian rocks, though composing extensive areas, form less than half the surface.

So many explorations have been made in north-west Africa in recent years, and the results are scattered through so many publications, that this synthesis with full bibliographies is of great value. The work has been thoroughly done: there seems to be only one trifling omission—of any reference to the invertebrate fossil fauna of the Sokoto district. Dr. Krenkel is to be congratulated on the completion of the work. A. M. D.

DIE KOLONIALE ENTWICKLUNG DES ANGLO-ÄGYPTISCHEN Sudans. By WALTER KRÄMER. (Neue Deutsche Forschungen, Abt. Kolonialwissenschaft. Edited by K. H. DIETZEL and J. F. GELLERT. Bd. 1.) *Berlin: Junker und Dunnhaupt Verlag*, 1938. 9×6½ *inches;* 240 *pages; sketch-maps. RM.*10.50

This is one of a series of German studies of colonial development which already includes Kenya and Uganda. A study of the Anglo-Egyptian Sudan was suggested to the author by Professor H. Schmitthenner. Assistance of others at Leipzig University was obtained, and literature was sought even as far afield as the library of the British Museum. Considering that Dr. Krämer has not visited the Sudan, and consequently does not possess first-hand acquaintance with the country, the book is a remarkable piece of work and contains an excellent and comprehensive account of the country. It seems that the German tongue wants a word to express a dependency as distinct from a colony. The Condominium of the Anglo-Egyptian Sudan is entirely unsuited for Englishmen to make their homes and it offers little attraction for Egyptians, though some industrious representatives of this people have established themselves. Its development is based on its own inhabitants, organized and assisted at present mainly by the British. Actually this is made quite clear in the text of the book before us. After outlining its physical features and its climate there is an account of the history, especially in modern times, including the Egyptian occupation in the early part of last century, the Dervish rising, the reoccupation by British and

Egyptian forces, and it is remarked that Britain's position in the Sudan has enabled her to secure the route through the Red Sea and has ensured control of Egypt. It may have happened so, but it certainly was not a deep-laid scheme in the minds of those who organized the reoccupation. On the whole, the book gives a remarkably fair account of the political and administrative spheres, as well as of the relations with Egypt, especially concerning the Nile water. The only serious error is contained in the statement that soon after the re-occupation, owing to the Dervish misrule, there was very little labour available locally, and landowners on the Nile imported negroes from Carolina and Louisiana to help in the development of their properties. Strakosch's book of 1910 is cited as the authority. There may have been a proposal of this kind which has served as a basis for this statement, but actually none of this labour was ever imported.

The author remarks that the critical faculties of the Sudanese are not yet sufficiently developed to enable them to size up political news, while the ideal of the Sudan for the Sudanese is almost impossible of attainment on account of the great differences between the peoples within its boundaries. Dr. Krämer notes that the British officials, though seeming to lead peaceful lives playing bridge and polo, actually maintain close touch with the situation which they control; that they are most carefully selected; and that the country is steadily advancing under their outstanding personalities. The effect of Britain's agreement with Egypt on the development of the Sudan has yet to be seen.

The several revenue-producing crops are dealt with, and in discussing cotton it is noted that the different season of production in the Sudan as compared with Egypt permits the seed to be sunned to free it from the grubs of the destructive boll weevil. There is a brief account of education, and finally there is a valuable bibliography which testifies to the author's thoroughness. The book is most carefully documented throughout. There are two maps: one shows the main political divisions, while the other illustrates the Gezira irrigation scheme. G. W. G.

## NORTH AMERICA

CANADA TO-DAY: a study of her national interests and national policy. By F. R. Scott. Prepared for the British Commonwealth Relations Conference, 1938. Issued under the auspices of the Canadian Institute of International Affairs. *London: Oxford University Press*, 1938. 9×5½ *inches;* xii+164 *pages; maps and diagram.* 6*s*

This book was prepared "at the request of the Canadian Institute of International Affairs as the principal Canadian paper for the second British Commonwealth Relations Conference." As such it begins with a survey of Canada's geographical position and structure, her population and her economic life. Then follow accounts of the political parties, the nationalist movement in French Canada, the constitutional and defence problems, and the general relations of Canada with the rest of the Commonwealth and with foreign countries. The author, who is Professor of Civil Law at McGill University, has striven throughout to show "the relation between internal forces and external policy." He brings out clearly the racial and geographical factors which influence so deeply this relationship. Racial factors centre in the mixed population and especially in the presence of a large French Canadian minority with its own way of life, its isolationist policy, and its "extremely powerful political influence at Ottawa." Geographical factors centre in the actual position of Canada, which involves isolation, in the physical sense, from Europe and integration with the

United States, where physical proximity has been reinforced by such economic ties as a foreign trade in which, in 1937, the United States took 41 per cent. of Canada's exports and supplied 58·7 per cent. of her imports.

This survey provides an admirable background for any discussion of Canada's position in the empire and in the world. Its value lies not so much in the marshalling of up-to-date facts and figures on population, production, and trade, though it is useful to have these in so clear and so accessible a form, as in its presentation of the political, constitutional, and legal problems which affect the internal structure and the external relations of Canada. These problems, as for example the difficult and important one of neutrality, are presented clearly and succinctly, so that many should profit from this study, which has in addition a brief but useful bibliography. Those for example who advocate a resumption of immigration into Canada might reflect on the following statement: "Canada, in the present condition of her domestic and foreign markets, appears already overcrowded. If agriculture merely holds its own and other rural employment is not forthcoming, a rural surplus of 800,000 is quite possible by 1941." Those again who suffer from illusions on dominion status might ponder over a Privy Council which "has been a fairy godmother" to Quebec nationalists. Finally, those who are concerned about imperial assistance in a future war might give serious consideration to an estimate which places "fully half the population of Canada" in the isolationist group. T. S. W.

NORTH AMERICA: an historical, economic, and regional geography. By LL. RODWELL JONES and P. W. BRYAN. Fifth Edition. *London: Methuen and Co.*, 1938. 9×5½ *inches;* xvi+578 *pages; maps and diagrams.* 22*s* 6*d*

The first edition of this work appeared in 1924 (see *Geogr. J.* 66 (1925) 164–5). Since then it has been republished four times, and on each occasion the statistics have been brought up to date. In this fifth edition the changes are for the first time considerable. Little has been altered in Part I, which deals with the historical geography. In Part II, economic geography, there are new chapters on the natural vegetation, on soils and soil erosion, on the physiographic provinces of the interior, and on the power resources of the U.S.A., all by the senior author. In the regional studies of Part III Florida no longer has a chapter to itself, and there has been a considerable textual revision, including a rewriting of much of this section. The additions maintain the standard of the book, which is now established as the leading text-book on North America in its class. It is noticeable that the criticisms on the diagrams made thirteen years ago are still valid. Several new diagrams have been added, but the revision of the text has not extended to that large majority of the diagrams which date from the first edition. C. B. F.

*ZACA* VENTURE. By WILLIAM BEEBE. *London: John Lane*, 1938. 9×5½ *inches;* xiv+316 *pages; illustrations and route-chart.* 12*s* 6*d*

In the spring of 1936 the *Zaca*, an 84-ton diesel schooner, spent two months cruising off the coast of California, from San Diego in the north to Clarion Island in the south. The present volume is a narrative of this cruise, and a popular account of the fauna and methods of collecting, diversified by a number of digressions more or less loosely connected with these themes. The more solid results of the zoological work done aboard the *Zaca* are being published in a series of papers in *Zoologica*.

In these circumstances it would be unfair to Dr. Beebe either to criticize his book as essentially a contribution to zoological literature or to treat it as a mere travel book descriptive of an ocean cruise. It is something between the two, and

its success must be measured by the vividness, precision, and completeness of the descriptions not only of the scenery and the attendant plants and animals by sea and land, but also of the spirit which drives a man to work of this kind, and the reflections which his observations engender in his mind. Judged from this standpoint the narrative fares better than the digressions. The larger members of the rich and varied fauna are described at length. The notes on birds and fish are the best, but there are ample and lively comments on turtles, sea lions, and a few *Cetacea*. Plants and the lesser animals of the sea are not so fully reported, and some of the author's remarks on the patchiness of their distribution are rather naïve. The leading characteristic of these descriptive sections is Dr. Beebe's unfailing enthusiasm. A number of the digressions concern subjects of no great relevance to the cruise, and some are shot through with a cloudy philosophy, which may give a misleading impression to readers who regard Dr. Beebe as the spokesman of the biological sciences. The author's habit of including unpolished paragraphs, which are scarcely more than catalogues of species observed, and the frequent use of highly coloured language detract from the value of the book.

The best chapters are those on the whale shark, and on a descent in the diving helmet at Clarion Island. The whale shark is a fish of great grandeur and rarity, and an authentic account, with a photograph, of encounters with it is very welcome. The wonders to be seen from the diving helmet in calm tropical waters are worthy objects of Dr. Beebe's enthusiasm. There is a good map and a number of good photographs. There is a full index, and in an appendix is a complete list of the Latin names of animals mentioned more intimately in the text. This last is a good means of combining instruction with entertainment.

A few of the generalizations in the book are inaccurate, notably that on p. 17 to the effect that "there has never been in the sea any development of flowers or seeds." G. I. C.

## CENTRAL AND SOUTH AMERICA

LATIN AMERICA: a brief history. By F. A. Kirkpatrick. *Cambridge: University Press*, 1938. 9×5½ *inches;* xii+456 *pages; portraits and maps.* 18*s*

LE PANAMÉRICANISME. By Eugène Pépin. (Collection Armand Colin. No. 218.) *Paris*, 1938. 7×4½ *inches;* 222 *pages; maps.* 15*fr.*

In an earlier volume in the Pioneer Series of histories Mr. Kirkpatrick dealt with the discovery and conquest of South America. The present volume devotes two chapters, clearly and concisely written, to those topics and but a quarter of its pages to the history of South America prior to the achievement of Independence. It is mainly concerned with the individual States of Central and South America, and challenges comparison with the recently produced Report by the Royal Institute of International Affairs (*Geogr. J.* 91 (1938) 484). To the latter Mr. Kirkpatrick appears to make no reference, though the two books are largely complementary: the Report, covering South America only, dealt with economic, social, and artistic developments for which Mr. Kirkpatrick had little space in his endeavour to do justice to the political history of the continent. He takes each republic in turn, deals briefly with the physical setting, and describes the main events in its history as concisely as possible. Judging by his quotations and the chapter bibliographies, he has made use of a wide variety of sources. A certain monotony is due chiefly to the events themselves; he avoids repetition by treating separately incidents such as the War of the Pacific, common to the history of three States. The style may not be brilliant, but the careful reader, provided with a good atlas, will have a clear understanding of the

differences of physical setting, national resources, and population conditioning the development of the various republics.

In one of his most interesting chapters Mr. Kirkpatrick treats of the movements within South America towards a greater unity. Confusion in Napoleonic times, especially as it affected Spain, rather than the spread of revolutionary doctrines, broke down the Spanish Empire and the unity that it had imposed on the bulk of two continents. Renewed confusion in Europe might favour a greater unity, deriving either from a movement within South America itself, or from cooperation with the United States, and possibly Canada. Mr. Kirkpatrick is inclined to regard *Americanismo* as largely sentiment, despite improved communications between the republics of South America and their recurrent distrust of the United States. The alternative is Pan-Americanism, and an examination of this, in all its aspects, is the subject of a brief, lucid, and attractively written survey by M. Pépin. M. Pépin defines Pan-Americanism as a democratic movement towards continental solidarity, a union of all the American republics on a basis of equality. He deals briefly with the abortive proposals coming from South America prior to 1889, and details the achievements of the series of conferences inaugurated in that year under the aegis of the United States; the ninth of this series terminated at Lima in December 1938. Apart from examining Pan-American institutions, which are compared with those of the League of Nations, and appraising the work of the conferences, the bulk of the book is an inquiry into the geographical, racial, and economic factors favouring Pan-Americanism. The physical isolation of the two continents may be more apparent than real, because of the poor communications within South America and the well-forged links between some of its States and Europe, and may not be enough in itself to unite the North American and Iberian, not to mention the Indian, worlds. The well-balanced economy of the United States hardly complements the ill-balanced economies of some of the South American States; the most stable of them, Argentina, has always stressed its links with Europe. South American nationalism, often pro-Indian, anti-capitalist, and anti-ecclesiastical, might increasingly stress the differences between the two continents. The part played by the Monroe Doctrine, elaborated for a century to mask the United States' need for expansion and recently allowed to sink into the background, is still uncertain; the Lima Conference has been interpreted as a final triumph for the Doctrine, and as marking its permanent eclipse. Certainly security is for the first time uppermost in the minds of both North and South, and the Lima Conference has justified M. Pépin's optimism about Pan-America, even if it failed to set up political machinery to give effect to its resolutions. M. Pépin is well aware that "the forging of an arsenal of pacific texts" is not the only result of these conferences: in economic, legal, cultural, and hygienic matters more tangible results have been achieved, and these he discusses in detail. His text however is not overcrowded with statistics. There is a brief bibliography, and adequate sketch-maps. J. P. H. M.

BRAZILIAN EL DORADO. By J. R. DE SÁ CARVALHO. Edited by C. R. ENOCK. *London: Blackie and Son*, 1938. 8 × 5½ *inches;* 166 *pages; illustrations and maps.* 5*s*

This small volume might be of more interest, light as it is, had it not been so drastically edited, although Mr. Enock, in the course of thirty pages of introduction, tells us that he is quite confident that he has satisfactorily recast the journalistic original, and has put the result into "appropriate English."

The reader thus does not know what Sá Carvalho actually wrote in his

"idiomatic Portuguese-English," nor are we told so much as the titles of his work; some at least of the material apparently appeared in the press of São Paulo city, and not unnaturally bears the mark of opportune journalism. Mr. Enock has missed his chance of modifying an irresponsible tendency, and indeed it is he, even more than the Paulista journalist, who indulges in suggestions and speculations *ad nauseam* regarding Atlantis, buried cities in South American forests, and, once more, the fate of Colonel Fawcett.

Sá Carvalho appears to have made a number of difficult journeys in his native land, and the best part of the little book is concerned with travel in Matto Grosso and the Amazon region. More detail of actual experience, and less questionable and biased history, would be welcome. Chapter XI for instance would gain by more personal observation in the long journey down the Araguaya to Belem do Pará, and the still longer water route from Villa Bella (Matto Grosso) to Buenos Aires, *via* the Paraguay and Paraná rivers, to the delta of the Plata.

There is no index. The endpaper map and the loose map at the end of the volume are inadequate. L. E. J.

## AUSTRALASIA AND PACIFIC

TIN CAN ISLAND: a story of Tonga . . . By CHARLES STUART RAMSAY and CHARLES P. PLUMB. [*London*]: *Hurst and Blackett*, [1938]. 9×5½ *inches;* 320 *pages; illustrations and charts.* 15*s*

LET'S SEE IF THE WORLD IS ROUND. By HAKON MIELCHE. (Translated from the Danish by M. A. MICHAEL.) *London: William Hodge and Co.*, 1938. 9×6 *inches;* 330 *pages; illustrations and route-map.* 12*s* 6*d*

The first of these books embodies the experiences of an eleven years' residence in the Tongan island of Niua Fo-ou, named Tin Can Island owing partly to difficulty in pronouncing the native words and partly to the fact that the mails were conveyed to and from the ships in cans when heavy seas during the hurricane season prevented communication with the land by boat. The hero, Charles Ramsay, enjoyed the privilege of swimming out to the ships with mails periodically, in addition to his regular occupation as the representative of a firm of copra traders.

Mr. Ramsay's experience was varied and interesting, and his narrative gives ample explanation of the fascination which life in these localities has for the American and European youth. Especially thrilling are the chapters dealing with shark and octopus hunting, volcanic eruptions, and a hurricane in which a small town was completely destroyed; while the island and people with their habits and customs are graphically described, and the reader often wishes that he also had been a witness of the quaint ceremonies. The illustrations in the shape of photographs taken by Mr. Ramsay himself are suitable to the subject-matter.

Hr. Mielche's book is the story of a Danish schoolmaster of a scientific turn of mind who suddenly sold his school and, having purchased a ship, sailed with the author, one of his pupils, across the Atlantic, through the Panama Canal to the New Hebrides, and thence to the Solomon Islands, where the vessel was left as a total wreck on the beautiful island of Vanikoro. In the earlier part of the book much seems to have been sacrificed to a form of humour which becomes rather tiring. The book contains much interesting matter, in spite of the fact that most of it treats of well-beaten paths. New light is shed on the composition of various Fiji communities and their customs, and the tragic end of certain European settlers in the Galapagos is described. There are some good photographs, and the letterpress is surrounded with amusing and decorative sketches. W. G. G.

## POLAR REGIONS

SOUTHERN LIGHTS: the official account of the British Graham Land Expedition, 1934–37. By JOHN RYMILL. With two chapters by A. STEPHENSON, and an historical introduction by HUGH ROBERT MILL. *London: Chatto and Windus*, 1938. 10×7½ *inches;* xvi+296 *pages; illustrations and maps.* 31*s* 6*d*

The British Graham Land Expedition, 1934–37, is notable both for what it achieved and for the small cost at which its gains were won. It was led by a polar explorer of considerable experience, and he had at his call a nucleus of experienced comrades to leaven the excellent material that the universities and the Services provide for such work. The finances of the expedition were cut to the bone, but by comparison with other expeditions more lavishly equipped, it appears to have gained more than it lost.

From its inception the expedition was unique, because its ship was manned by an amateur crew with only a slight stiffening of real sailors: Rymill both showed courage and courted criticism by this departure. The decision to sail the *Penola* from the Falkland Islands to the Antarctic with her engines out of line, and therefore out of action, was another bold action that was justified by its success. References such as those to graphite grease and propeller guards as preparations for Arctic seas show that self-confidence was due not to ignorance but to a sane awareness of the conditions to be met. The grouting of the engine-bed of the *Penola* with cement was only one proof of the ability of officers and crew to measure up to the task they had undertaken.

This same competence is also the characteristic feature of the shore life of the expedition. The chief contribution to polar technique lies in the coordination of aeroplanes, wireless telegraphy, motor boats, and dog sledging in the service of scientific exploration. This is seen in the use of the aeroplane to seek a way for the ship through ice-infested seas, amidst islands, and over shoals; in the use of the motor boat for sounding harbours; and in the use of wireless from ship to 'plane to convey directions and information of landing conditions. The book starts with a warning of the limitations of the aeroplane as a means of detailed survey under polar conditions. Indeed the whole plans of the expedition had to be reshaped because of faulty information handed down from earlier flights. Yet the expedition itself proved, as none had done before, the supreme value of the aeroplane in extending the range of sledging parties. We are told of a depot laid 100 miles from the base with trifling expenditure of energy and time; of warning given of bad ice conditions on sea and land; of routes pioneered across tumultuous glaciers by means of air photographs showing the grouping of the crevasses. Only men who have groped their way over similar country under the old blindfold conditions can realize all that this means. Battery wireless sets record time signals to assist surveying parties. Members of sledge teams, themselves accustomed to aerial travel, lay out lines of flags to indicate possible landing-grounds alongside their camps; aeroplanes land to pass the time of day; and waste of time and energy through overlapping diminishes or disappears.

The history of the dogs, too, shows the same workmanlike appreciation and understanding applied to the oldest as to the newest form of polar transport. The loss of some 85 per cent. of their dogs might well have dismayed both leader and men. Some of the substitutes were so unfit that they "died of old age" during the expedition. Yet these trials only served to afford another chance of showing the stuff of which the explorers were made. Of the surviving dogs at the end of the expedition 56 per cent. were born in the Antarctic. This

success was due to a solicitude that has not often been shown by dog breeders under better conditions than a polar base.

It is interesting to note that in spite of this efficiency the Graham Land conditions kept the mileage average down to 6·5, a figure that must have disappointed men used to the speedier conditions of the north.

The narrative itself is workmanlike rather than brilliant, but there has been nothing quite like it before because of the technique that it describes. No polar library will be complete without it. It is to be commended to all who have a particular or general interest in polar work as being the last word on its own subject: the application of modern science to the exploration of polar lands and seas. It is lavishly and pleasantly illustrated with photogravures, and its equipment of maps is far above the average, as is their quality. They are a better tribute to Mr. Stephenson, the map-maker of the party, and to the draughtsmen than any words of the reviewer could be. R. E. P.

ON THE TOP OF THE WORLD: the Soviet expedition to the North Pole 1937. By L. BRONTMAN. Edited and with a foreword by O. J. SCHMIDT. *London: Victor Gollancz*, 1938. 9×5½ *inches;* 288 (*inc.* xiv) *pages; illustrations and maps.* 16*s*

The author is a journalist attached to the expedition and writes in a manner which should interest almost all types of readers. Professor Schmidt, the leader, states in his foreword that Brontman gives a conscientious description of the work of the expedition, and it is possible to picture each individual member.

There is a short outline of previous attempts to reach the North Pole, and Brontman tells how the idea, first voiced by Nansen, of using aircraft alone to establish a winter station on the pack-ice was thought out and discussed by Professor Schmidt when waiting to be rescued after the loss of the *Chelyuskin*. He wasted no time on his return to Moscow in putting his final plans before Stalin and the Soviet Government. The author gives a full and vivid description of all the preparations, selection of the personnel for the aircraft crews, and of Papanin's companions for the winter party.

This book is not a complete account of the expedition, but concentrates on what was perhaps the most outstanding feature, namely the indubitable conquest of the North Pole. This success is in no way diminished when one considers the extent to which the expedition was supported by the Government, but it is a fact that must be borne in mind when comparing it with other attempts. The Soviet Government realize the great possibilities of opening up the air communications by way of the Arctic, and the full resources of the country were put at the disposal of Professor Schmidt. No other expedition has had such an opportunity in recent years. Every piece of equipment was carefully planned, produced, and tested, in the light of much polar experience, until considered satisfactory; so that when the expedition set out from Moscow the leader and his colleagues were confident of success.

The author admits that he has little knowledge of flying, and some technically inaccurate statements are in evidence, but his excellent description of the flight to the Pole, of the establishment of the winter station and the triumphant return to Moscow suffers little. Radio communication played a very big part throughout the expedition, and it is of great interest to learn that a wind-operated dynamo kept the winter party's radio working during their stay on the ice. In addition to this description of the flight and the establishment of the station, Mr. Brontman provides many details of life on the ice-floe.

Throughout the book the efficiency of the Soviet organization is stressed, at times perhaps too forcefully, and it is a relief in the end to discover that the

scientists left their supply of alcohol for preserving specimens behind at Rudolf Island. This misfortune was happily remedied by the super-efficiency of those responsible for the supply of alcohol for human consumption. W. E. H.

SAGA OF THE *DISCOVERY*. By L. C. BERNACCHI. *London: Blackie and Son*, 1938. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xvi + 240 *pages; illustrations and maps.* 10*s* 6*d*

It was a happy thought of the author's to dedicate this book to "The Boy Scouts of the world, who enshrine the best spirit of adventure," and no more profitable field of adventure could have been chosen than the Antarctic regions in the early years of this century. For those who are now privileged to use *Discovery*, and for those interested in her travels, Commander Bernacchi's book provides for the first time a complete account of her three voyages to the Antarctic, and of her travels in more temperate climates.

Two-thirds of the book are devoted to *Discovery's* voyages, the greater portion dealing with Scott's first expedition, and there are two chapters on the work done for the *Discovery* Committee in 1925–26, and the B.A.N.Z.A.R. Expedition, 1929–31. All too few pages concern the *Discovery* herself, and too many deal with extraneous subjects that have been more completely dealt with elsewhere. It is unfortunate that in a book with such a dedication old feuds and grievances should be revived.

The last portion of the book contains a chapter on Antarctic phenomena, and another giving short biographies of some of those who sailed on *Discovery's* first voyage. For those who now use *Discovery* it must be of great interest to know the subsequent history of the men who manned her in her greatest voyage of adventure. The chapter on Antarctic phenomena seems out of place in such a book as this, with its almost casual references to such subjects as the extinct Tetrahedral Theory or the Hobbs-Meinardus controversy.

The book is very well illustrated with photographs, drawings, and maps, although one would have preferred an up-to-date map of the Antarctic on the inside cover. A. S.

## PHYSICAL AND BIOLOGICAL GEOGRAPHY

THE SUN: its phenomena and physical features. By GIORGIO ABETTI. Translated by ALEXANDRE ZIMMERMANN and FRANS BORGHOUTS. *London: Crosby Lockwood and Son*, 1938. $9 \times 5\frac{1}{2}$ *inches;* 360 *pages; illustrations.* 20*s*

This excellent translation of Professor Abetti's book on the sun gives a particularly clear account of solar phenomena, and of the place of the sun among the stars. The general reader will find no serious difficulty in reading any part of it, while the expert will find much of value in the full treatment of phenomena which occur on the sun's disc.

We are here concerned with that part of the book which treats of the relationship of solar and terrestrial phenomena. Chapter VIII summarizes what is known, as well as some of what is only surmised. The most definite correlations which have yet been established are those between solar activity and magnetic fields, electric currents in the atmosphere and polar aurorae. The dependence of the intensity of the magnetic field of the earth on the sunspot cycle and the occurrence of the so-called magnetic storms associated with disturbances of the sun's disc are described, examples being given of the occurrence of intense magnetic storms following the appearance of sunspots and other disturbances of the sun's disc.

The author wisely takes the view that it is not possible to say how much the variation of the solar constant and of the measured intensity of ultra-violet

radiation should be ascribed to true solar variation, and how much to variation in terrestrial atmospheric conditions. He refers to the evidence that the levels of the great equatorial lakes of Africa vary in the same sense as the sunspot cycle. Readers of this journal will remember that the later records of the lake levels do not bear out the idea of close relationship with sunspots (*Geogr. J.* 89 (1937) 226, Fig. 10). Professor Abetti also points out that the evidence of the trees measured by Douglass is by no means capable of simple interpretation. The cosmic origin of the polar aurorae, first suggested by Donati in 1872, is shown by a number of actual observations to be fully borne out. Finally the author refers to the sporadic attempts to convert solar energy into heat, and suggests that some day success may be obtained in this effort.

This excellent book confirms our earlier ideas that the correlation of solar phenomena with meteorology is less clear cut than that with other geophysical phenomena mentioned above. D. B.

GRUNDZÜGE DER PHYSIKALISCHEN VERHÄLTNISSE DER festen Erde, ihre Beziehungen zur geologischen Gestaltung des Erdantlitzes. By ERNST TAMS. Zweiter Teil (Schluss): Die endogenen Bewegungsvorgänge und ihre Äusserungen. Geologischer Bau und Erdmagnetismus. *Berlin: Borntraeger*, 1937. $10\frac{1}{2}\times7$ *inches;* viii+185–377+8 (*plates*) *pages; maps and diagrams. M.*16

This book deals in turn with thermal and mechanical processes in the earth's crust, their relation to the formation of mountains and continents, volcanoes and earthquakes, and terrestrial magnetism. The principal geophysical theories are critically discussed, particularly in their relation to geology. Mathematics is avoided, but quantitative results are quoted. The author's reading has clearly been wide, but the book is no mere catalogue of what others have thought; he has something useful of his own to say at each point. H. J.

## CARTOGRAPHY

INTERNATIONALES ARCHIV FÜR PHOTOGRAMMETRIE. Edited by C. F. BAESCHLIN. VIII Band. Zweite Hälfte. *Brunn: Rudolf M. Rohrer*, 1937. $11\frac{1}{2}\times8$ *inches;* xii+446 *pages. RM.*33

SOCIÉTÉ INTERNATIONALE DE PHOTOGRAMMÉTRIE. Quatrième Congrès International de Photogrammétrie, Paris, 1934. Procès-verbaux des séances des Commissions. Edited by H. ROUSSILHE. *Paris: Imprimerie du Service Géogr. de l'Armée*, 1936. $10\times7\frac{1}{2}$ *inches;* iv+396 *pages; illustrations.* 50 *fr.*

The Fifth International Congress of Photogrammetry took place during October 1938 in Rome. A short while before its opening these reports became available of the previous Congress, held in Paris in 1934. The delay in publication of the second part of vol. VIII of the *Archiv* has been due to the difficulty of collecting the various international contributions; the editor states that these difficulties are now so great that publication of the series will cease with the present issue. The *Archiv* has been a useful record of photogrammetric activity, and it is deplorable that this kind of international effort should become impossible. On the other hand the usefulness of the number under review is reduced very much by the fact that practically its entire material is contained in the *Procès-Verbaux*, even to the extent of being largely in the same language.

The Congress sits in a number of commissions, each of which considers some single aspect of the subject. But photogrammetry is now so advanced a science that the papers are practically without exception highly technical and

intended only for the specialist. Two are perhaps of more general interest. Professor Finsterwalder claims that, even for small-scale mapping, terrestrial photogrammetry can be economically applied. Recent experience in the Himalaya leads the reviewer to think that there is probably more scope for the original single-picture photogrammetry than is generally admitted. Professor Finsterwalder is of course discussing stereo-photogrammetry with mechanical plotting, a procedure which may well produce a map too detailed for the purpose in view, and which certainly entails in the choice of a base a great restriction in the possible positions which can be occupied and a great increase in the work to be done in the field. The French archaeologist Père Poidebard describes some interesting experiments in obtaining photographs of ruins in the Syrian desert. He discusses the various factors influencing conditions of visibility, and finally states that best results are obtained by flying early in the day at a very low altitude (not more than 200 metres) along a course towards or away from the sun. Photographs are then taken with the camera set at a comparatively small angle with the horizon and at right-angles to the line of flight. M. A. S.

SURVEYING AND FIELDWORK. By JAMES WILLIAMSON. Second edition. *London: Constable and Co.*, 1938 (*first published in* 1915). $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xxvi + 512 *pages; illustrations and plans.* 20*s*

This book in its revised form covers a large ground superficially, but on studying it in detail one finds it rather unsatisfying. It must be remembered that it is primarily for engineers, and that the basic principles of surveying which it claims to cover do not include field astronomy or any mention of it. For the same reason triangulation is dealt with in one chapter, and in a very general way.

Surveying instruments in general are described in detail and some of the more recent instruments are mentioned, the modern level receiving more attention than the "Tavistock," which is the only recent theodolite dealt with. A special chapter deals with the adjustment of these instruments, though not in sufficient detail for the serious student of this subject.

The principles and practice of levelling are dealt with very fully, and the use of the theodolite is described sufficiently for those who are using it "on a modest scale." One would like however to have seen an illustration of the method of booking theodolite angles.

The author pays particular attention to traverse surveying and tacheometry, and of the latter subject he has made a speciality. The "ordinary method" of tacheometry is dismissed in a few pages, and from the student's point of view this is inadequate. Some eighty pages however are devoted to the author's "simplified method" and its application. Various simplified methods have been used in the past, and are still in use, but this is yet another in which the main innovation is a speeding up of the actual time of observation. This is accomplished by using two stadia hairs instead of three, only the upper of which is read, the lower one being sighted on to the zero of a special staff, the graduations of which start about 4 feet 6 inches from the bottom. Such readings are reduced with the aid of a special reduction table, the making and use of which are fully explained. This method has been used and applied in the field for a period extending over sixteen years, and the author claims that it is satisfactory. It will no doubt appeal to those who like using diagrams and tables in the field, but for those who prefer a little more arithmetic and a smaller and handier form of table, the "ordinary method" will still have its attraction. Moreover in the "simplified method" aggravating circumstances may occur, as for example when the special zero happens to be hidden by some obstacle.

The plane table is just mentioned in connection with tacheometry, but one

would have expected in a book of this type a more detailed description of its uses. Likewise it is surprising not to find resection methods and their limitations mentioned.

The author hopes that the book will maintain its appeal to the student and be of enhanced value to the practical surveyor. For those who have started in the field, without special instruction, the book will doubtless have its attractions, for it describes most of the general problems clearly and in great detail, but for the student it appears to be too general. Diagrams and illustrations are numerous and helpful, but in one or two cases open to criticism. There is no illustration of a complete traverse table showing both adjustments and corrections on the same page, and in the example of a traverse field-book one would have preferred a double line down the centre of the page. A. S.

ÜBER DIE NIVELLITISCHE REFRAKTION. By T. J. KUKKAMÄKI. *Helsinki: Finnish Geodetic Institute*, 1938. $9^1_2 \times 6^1_2$ *inches; 48 pages; maps and diagrams*

In order to discover the effect of refraction in precise levelling the author first investigates the influence of the gradients of temperature, humidity, $CO_2$ content, and pressure on refraction. To this end he selects the formula for the index $n$ of refraction reached in 1918 by W. F. Meggers and C. A. Peters, of the Bureau of Standards, Washington, and finds that the temperature gradient is the only significant element. The temperature gradient can be obtained experimentally from a "resistance thermometer" giving the relative temperature of two points at different heights above the ground: the relative electrical resistance of two platinum coils at these heights is observed on a Wheatstone bridge, and thence the relative temperature is deduced. Records of differences of temperature between heights of 2·5, 30, and 120 centimetres were made in southern England by A. C. Best at intervals of every two minutes of day and night for two entire years (*Geophysical Memoirs*, No. 65, 1935). Meaned for the hour and the month these observations prove that the gradient is greatest around midday, it being then negative; that zero occurs about one hour after sunrise and an hour before sunset; and that at night the refraction is positive and except in winter is considerably less numerically than the midday value. During the day therefore differences of levelled height are too small and at night too great. The tables summarizing these researches provide a "period constant," as it may be named, which affords a measure of the temperature gradient for each month of the year and each hour of the day.

To attain his object the author requires a relation giving the temperature $t$ at a height $z$ when the temperature gradient is shown by the period constant $c$ above. He examines several empirical formulae which have been proposed, and finding them unsatisfactory adopts a form of his own. This formula, $t=a+bz^c$, where $a$ and $b$ are constants, is peculiar, as the author admits, when $z$ becomes zero, since $c$ may be positive or negative, varying from $+0{\cdot}8$ to $-0{\cdot}8$. However $z$ will always be regarded as positive and very small differences of height have no refractional effect on levelling provided that the level is placed nearly midway between the staves. The formula is therefore workable under practical conditions; but though it is admittedly empirical its peculiar feature would appear likely to imperil its general acceptance.

The well-known equation of a ray in air, when the strata are arranged in spherical shells around the earth, is $n \cos \alpha = \text{const.}$, where $n$ is the index of refraction and $\alpha$ is the inclination of the ray, and the shells may be considered horizontal for the small "shots" of spirit levelling. Using this equation and the relation mentioned above, together with a cloudiness factor $w$, the author

integrates the effect of refraction on the difference of height of two staves separated by the span $2s$. The altitudes of the bench marks in Finland were recomputed accordingly. At the closing stations of circuits the greatest total correction found was 17 millimetres; but it may be taken that in mountainous regions the correction would be considerably greater.

Out of eleven closures of circuits, eight are improved by the corrections thus introduced. The mean square error by the new formula of Jean Vignal (*Bulletin Géodésique*, No. 49, 1936) is reduced from $\pm 1{\cdot}31$ millimetres per kilometre to $\pm 1{\cdot}20$ millimetres per kilometre.

Refraction varies with the square of the shot $s$; in Finland the shot ran from 40 to 80 metres, and in the author's opinion, to which the present writer fully subscribes, shots of 100 metres and over are productive of excessive refractional error, apart from other objections to them.

This is not the first work undertaken to correct the errors of differential refraction in precise levelling, but it is the first which we have seen applied to the net of a whole country. Further, the originality of the treatment, combined with the embodiment of the most recent investigations, is undoubtedly stimulating. G. T. M.

## ECONOMIC AND HISTORICAL GEOGRAPHY

MAN THE WORLD OVER. By C. C. CARTER and H. C. BRENTNALL. *Oxford: Basil Blackwell*, 1938. $8 \times 6$ *inches;* xxii + 508 *pages; illustrations and maps.* 8*s* 6*d*

The presentation of scientific subjects in a readable and attractively generalized form is a modern trend; it draws attention to the more spectacular aspects and reduces to a minimum the more humdrum framework. While such books fulfil a useful function they have to be prepared with extreme care, for over-generalization and over-simplification are in themselves as useless as the old-fashioned and laborious lists of capes and products. The authors and publisher have prepared a pleasing volume with clear type, bold sketch-maps, photographs, and thumbnail marginal sketches. Every page has at least one illustration. It is difficult to discover the precise function of this book, whether it is for children or for the man in the street. The material is well presented and makes pleasant reading, yet when portions are examined critically there are inaccuracies and inconsistencies which probably result from over-generalization. On p. 189, for example, the map illustrates the monsoon winds as completely reversing, and the curving of the monsoon from the Bay of Bengal is totally ignored, as it is in the maps of the Indian monsoon winds on p. 198. The authors define the London Basin, show it on a series of maps as including towns such as Canterbury and Chelmsford, and yet state on an adjoining page that Reading is one of the few towns in the Basin with a life of its own. It is unfortunate that in this series of maps of the London Basin the massive outcrop of the Chilterns has been given without any indication of the cross valleys, thus implying that the railways tunnel directly instead of using gaps. It is this over-simplification that is the weakness of the book for the serious reader. The very boldness of the diagrams gives sometimes incorrect information: on p. 423 the section across the Wealden area gives a hog's-back profile to the chalk, and the authors miss the correlation with the photograph on the facing page. Despite these flaws the book does give a picture of the activities of man, and the excellence of the illustrations alone will stimulate interest. A. C. O.

## GENERAL

THE ATLAS OF TO-DAY AND TO-MORROW. By ALEXANDER RADÓ. Maps by M. RAJCHMAN. *London: Victor Gollancz*, 1938. $8\frac{1}{2} \times 10\frac{1}{2}$ *inches;* x+198 *pages* (*including* 209 *maps*). 10*s* 6*d*

This atlas has been designed to assist in the understanding of "the bewildering mass of contemporary political and economic problems." Each black-and-white sketch-map is faced by a page of descriptive and statistical material. The main subjects covered are the evolution of the territorial organization of the world since 1875, the great Powers and their colonial empires of to-day, world markets and communications, and national, religious, and political problems. These are dealt with in a clear and straightforward manner; though the compiler's outlook can be deduced without difficulty, there is no other disposition than to present the facts to the reader for his consideration.

The sketch-maps are clearly drawn, though without any particular distinction, and for the most part do not attempt to show too much detail, though occasionally some of the diagrams tend to be illegible. All the world maps are on Mercator's projection, even when the information conveyed extends to the polar regions. In dealing with population and economic products, no attempt is made to show their distribution within each country, so that significant factors are sometimes masked, and the maps add very little to the statistical tables. On the other hand the maps of communications and territorial organizations are useful. The use of the terms "Norwegian empire" and "Danish empire" appears rather far-fetched.

These remarks are not intended to detract in any way from the general value of the work. The accurate presentation of so comprehensive a body of facts in a conveniently handled and cheap volume is a distinct service at the present time, and it forms a useful supplement to the more orthodox general atlas. Every effort to emphasize the value of maps for a proper understanding of world problems is to be welcomed. G. R. C.

PEAKS AND VALLEYS. By F. S. SMYTHE. With seventy-six reproductions of photographs by the author. *London: Adam and Charles Black*, 1938. 11×8 *inches;* xii+130 *pages*. 12*s* 6*d*

Mr. Smythe and his publishers are to be congratulated on having produced this excellent book of mountain photographs. It makes an admirable companion to his previous book 'The mountain scene,' and the high standard set by that publication has been fully maintained. Mr. Smythe's photographs substantiate his claim that photography is an art, and his pictures certainly recapture much of the essential atmosphere of mountains; he selects exceedingly well both in the detail of his photographs and in their vivid contrasts. In the letterpress the style is sometimes exaggerated and pompous. How for example can the Matterhorn be "something more than unique" (p. 9)? Why should the unfortunate tourists who climb it, even though they may be out of place, be described as "subhuman"? One sentence on p. 70 almost exactly repeats another on p. 42, and there are a number of minor mistakes.

As a collection of photographs the book is delightful, except for the coloured frontispiece. The choice of subject is admirably varied, and the mountain scenes are set off by pictures of the people who live near them. The photograph of the shepherd (Plate XLII) is a fine portrait study. Mr. Smythe states that "the two prime requirements of photography are to see beauty and to arrange it"; he has achieved both these essentials, and the result is a book of real value. E. E. S.

# THE MONTHLY RECORD

## ANOTHER SAXTON PLAN IN YORKSHIRE

The centenary exhibition at the Public Record Office included two plans drawn by Christopher Saxton, showing certain fulling mills on Luddenden Brook, near Halifax. A description of these brought news of another Saxton plan in the office of a firm of mining engineers at Wakefield. It is a survey of the Snapethorpe Hall estate of the Pilkington family, on the western side of the city. The site is now largely covered with the Lupset housing estate of the corporation.

The plan is on vellum measuring 28 inches by 30 inches. Saxton's style is evident both in the double border, with the names of the cardinal points (in Latin). within the lines, and in the pair of compasses spanning the scale of 64 perches. The title enclosed in an oblong frame of scroll work reads: "A PLAT of Mr. Pilkinton his landes, belonging to the old Haule & new Haule, in the parish of Waikfeild, Made by Christofer Saxton An° 1601." Underneath this panel is another ornament, with a capital R and S in a circle at either end. I have no doubt these are the initials of Robert Saxton and imply that he assisted his father in the production of the plan. Again below come two large double circles. The one on the right is filled with an elaborate compass-dial. The other, within the border, shows a rustic, in black and white motley, holding a scythe. This mower is the ancient seal of the Pilkingtons and still figures as the crest of Sir Thomas Pilkington of Chevet Hall. W. B. C.

## ANNUAL REPORT OF THE OXFORD UNIVERSITY EXPLORATION CLUB

The tenth Annual Report of the Oxford University Exploration Club contains brief accounts of the biological expedition to the Cayman Islands under the leadership of J. W. G. Alexander, and of the expedition to West Greenland led by J. C. G. Sugden. The former has returned, and is now preparing its report; a preliminary account of the work of the latter is included in the present Report, though some of the party remained on the ice-cap until November 1938. There is also a description of the activities of the Faroes Biological Expedition, 1937, outlined in the ninth Report.

Mention must be made of an interesting note, accompanied by two photographs, on the Mott tent, described as a "two-man Arctic tent," designed by P. G. Mott and made by Messrs. Thomas Black and Sons (Greenock), Ltd. Its design is streamlined, and therefore it offers minimum resistance to the wind. The lower end, which contains the door, resembles a Whymper tent with its side poles, whilst the higher end contains a vertical central pole beyond which is a bay resulting from the streamlined form of the tent. Apart from the higher windward end and lower entrance, the streamlined form is maintained by a number of guys.

The entrance door takes up the full width of the tent (nearly 5 feet), and although designed for two men the tent can easily accommodate four. A groundsheet with a 3-inch turn-up is made to fit the tent and can be fastened if necessary by means of dutch-lacing. A mosquito-proof window is provided at the higher end which allows ventilation without opening the door.

The Report says that the tent has been tried and proved to be excellent. Certain criticisms offer themselves however. To take full advantage of the tent it must be pitched in one direction only, and that determined by the wind. A number of Arctic camp sites do not allow of such a choice. The tent has only been tried in the summer, but if used on snow the result of a blizzard would be

to block up the entrance completely. Experience has shown that, if a tent has to withstand drifting snow, it is better to have the entrance across the wind, and preferably a sleeve entrance.

The designer suggests that for very cold climates the tent cloth should be double thickness with an air space between. This however would involve even more guys, of which there are already quite enough, considering the difficulty of keeping guys taut or even fixed at all in deep soft snow. As a summer Arctic tent however it has been proved successful, and with its total weight of 12 lb. should be welcome to explorers, for a spacious but light summer tent has been required for some time. A. S.

## EASTERN TURKISTAN

The economic resources of eastern Turkistan and its relations with the neighbouring Powers are examined by Dr. Fuad Kazak in *Osteuropäische Forschungen*, 1937, N.F., Bd. 23. Exact figures for trade are lacking, but the writer has collected a good deal of information from British and Russian sources. The bulk of the population being nomadic Turki tribes, the resources of the country have been scarcely touched. Before the war Russia was interested in cotton from Kashgar, owing to its low price compared with that of west Turkistan, but conditions have now changed. Some half a million head of cattle, and most of the wool produced, also go to Russia. The mineral resources have attracted more attention, and in their development the Turk–Sib railway should play an important part. Alluvial gold is found in large quantities in the Kunlun mountains, but the exact amount exported to China is not known. In the Dzungaria–Altai region the output of gold between 1925 and 1928 is said to have ranged from about 400 to 1300 kilogrammes. Coal is widely found in east Turkistan, though at present the only area of economic significance is in the Ili basin near Kuldja, from which it would be possible to supply the Turk–Sib railway and the cotton-manufacturing areas of west Turkistan.

The greater part of the monograph is devoted to tracing the position of the country in international politics since 1870. The conclusion is reached that its future will be determined by the outcome of the Russo-Japanese conflict of interests.

## THE PROBLEM OF SOIL EROSION

The literature dealing with the question of soil erosion continues to increase as its urgency becomes more apparent. Dr. R. Maclagan Gorrie has recently published two papers which deal with its general outlines and its particular aspects in the Punjab (*J.R. Soc. Arts* 86 (1938) 901 and *Scottish Geogr. Mag.* 54 (1938) 284). In the first he emphasizes the importance for subtropical regions of a study of the soil profile, to avoid the sealing of the surface by heavy ploughs or the trampling of cattle. He also points out that the nearer the area is to desert conditions the more difficult it is to re-establish the original ecological balance, and that non-eroded soils are much richer and have a higher water-holding capacity. The results of recent experiments in India are striking: a gently sloping field at Sholapur under sorghum was found to be losing soil at the rate of 115 tons per acre per annum, largely as the result of two very heavy storms. This emphasizes the need for contour ridging, which requires the consolidation of scattered plots to be successful, and shows that agriculture may be as serious a cause of soil loss as over-grazing. With regard to the destruction of forest, re-afforestation on a sufficiently large scale is almost impracticable: further inroads however can be checked by providing species which will yield good supplies of lopped fodder, and by encouraging the growing of live

hedges to check the cutting of thorn branches. The crux of the problem is the large scale of the measures required, which necessitate the cooperation of a conservative peasantry and the various administrative services, agricultural, revenue, and forestry. The rural reconstruction programme in the Punjab is starting to educate the population by broadcasting, the maintenance of demonstration plots, and the appointment of special officers to carry out control plans.

In the second paper, the writer deals particularly with conditions in the Punjab, where the problem centres in the pressure of the population upon the forest areas. Attempts to decrease the great flocks of cattle have met with opposition on religious grounds, and the only solution lies in persuading the peasantry of the value of fewer and better cattle, maintained by a minimum of common grazing and a full use of stall feeding from cut fodder, the avoiding of concentrated grazing and the improvement of wild grassland. The necessity of protecting the catchment areas of large irrigation schemes is stressed.

Sir Albert Howard, in a note following this paper, points out that erosion does not always lead to soil deterioration, and instances the formation of fresh soil by the weathering of the basalt in the cotton areas of central India.

In No. 1 of the University of Sydney Publications in Geography, Professor J. Macdonald Holmes also discusses the general problem of soil erosion, reinforcing in general the arguments of Dr. Maclagan Gorrie. Whatever the density of vegetation, some erosion will take place, and farming and cropping will of necessity lay bare the soil for some period; nevertheless, if man fits his work into the soil-building rather than the soil-destroying forces, the cultural landscape need not suffer greater erosion than the dispossessed natural landscape. In the agricultural valleys of New South Wales, where the lower slopes are under cultivation, he argues for the maintenance of the middle slopes in grass and the upper slopes in trees. He attributes the deterioration of grasslands to erosion leading to the establishment of harder grasses rather than to selective feeding. He believes with the previous writer that the solution will ultimately require a decrease in the size of individual properties.

## RECENT BIBLIOGRAPHIES

The volume of the *Bibliographie Géographique Internationale* for 1937 was published in January, and is now being sent to subscribers in the British Isles and the Dominions. The conditions under which the Society has undertaken to distribute this publication have already been explained in the *Journal* (*Geogr. J.* 85 (1935) 109; 89 (1937) 190). The price of the current volume has been fixed at 9*s* post free, and orders should be sent to the Office of the Society as soon as possible. It is a volume of 580 pages, containing over two thousand main entries, most of which are composed of numerous separate references, and are briefly annotated. Geographers of many countries, under the direction of M. Elicio Colin, have assisted in its compilation, and its usefulness deserves wider recognition in this country.

A Supplement (No. 61) to the *Geographical Journal*, Recent Geographical Literature, Maps, and Photographs, will shortly be distributed free to those Fellows who have signified their wish to receive it. It covers additions to the Society's collections between June and November last.

The third volume of the subject index of the London Library, edited by Sir Charles Hagberg Wright and C. J. Purnell, was published in 1938. It deals with additions to the library between 1923 and 1938. In addition to books, a large number of pamphlets and the contents of the proceedings of learned societies have been included. A useful feature is the indication of those volumes which contain bibliographies. The system of arrangement is simple, and is

supplemented by very thorough cross-references. The field covered by the library is very wide, and publications of interest to geographers are well represented.

### THE LOWER YANGTZE TERRACES

Owing to an oversight, in connection with the paper by Mr. Hanson-Lowe in the January *Journal*, the author omitted to mention the great help and courtesy afforded him by the Director of the Institute of Geological Research at Nanking, Dr. J. S. Lee, by the staff of the Institute, and by Dr. Y. Y. Lee in particular.

## OBITUARY

### REYNOLD BRAY

Mr. Bray, whose death by drowning on September 14 last was reported at the end of December, had had considerable experience of Arctic travel. He was a member of the Oxford University Exploration Club expedition to Hudson Strait, which in 1931 spent a month on Akpatok Island. The following year with Mr. T. H. Manning he made a winter journey through Swedish and Finnish Lapland. In 1936 he joined the British Canadian Arctic Expedition organized by Manning as ornithologist and surveyor. The party reached Southampton Island in June. Bray spent some time collecting at the mouth of Boas river, one of the two known breeding grounds of the blue goose, of which he was able to secure a very complete series. He then joined Manning and Bennett on their difficult journey by whale-boat to Repulse Bay, where the party wintered. As a result of this and subsequent journeys, Southampton Island and the coast-line from Wager Bay to the southern end of Melville Peninsula was mapped. In company with Graham Rowley, Bray then made a sledge journey to Igloolik Island off the north coast of Melville Peninsula. After staying a month at the mission station, they left in March for Jens Munk Island to the east and surveyed the previously unvisited western coast of Baffin Island as far south as the point reached by Hantzsch in 1911, discovering two large islands.

Bray returned home at the end of 1937, and in cooperation with Patrick Baird planned another expedition to Baffin Island. Their intention was to return to the farthest point on the west coast of Baffin Island reached on the 1937 journey, and to make a number of journeys into the interior, finally crossing to Clyde Inlet and returning by the R.M.S. *Nascopie*. They left Churchill on the Mission ship *Thérèse* on August 12 last year. The ship reached to within a day's sail of Igloolik, and was then forced to turn southwards owing to heavy ice which was drifting down exceptionally early. When off the south-east of Melville Peninsula, they decided to leave the *Thérèse* and to attempt to reach Igloolik, 300 miles north, in their boat. They appear to have made good progress at first as the accident occurred within 40 miles of Igloolik. A message received from Baird states that while he was on shore on September 14 Bray was blown out to sea in a folding boat. Baird attempted to rescue him in the whale-boat, but failed owing to the speed with which he disappeared. Baird then continued to Igloolik, and thence to Repulse Bay when there was good snow. He is proposing to carry out the journey to Baffin Island as originally

planned, perhaps in company with Graham Rowley, who is also at Repulse. Manning has planned to reach the same portion of the Baffin Island coast by a boat journey round the southern shores of Foxe basin.

Mr. Bray, who was twenty-seven years of age, was educated at Harrow and Balliol. He leaves a widow and a daughter. He became a Fellow of the Society last year.

### H. CHARLES WOODS

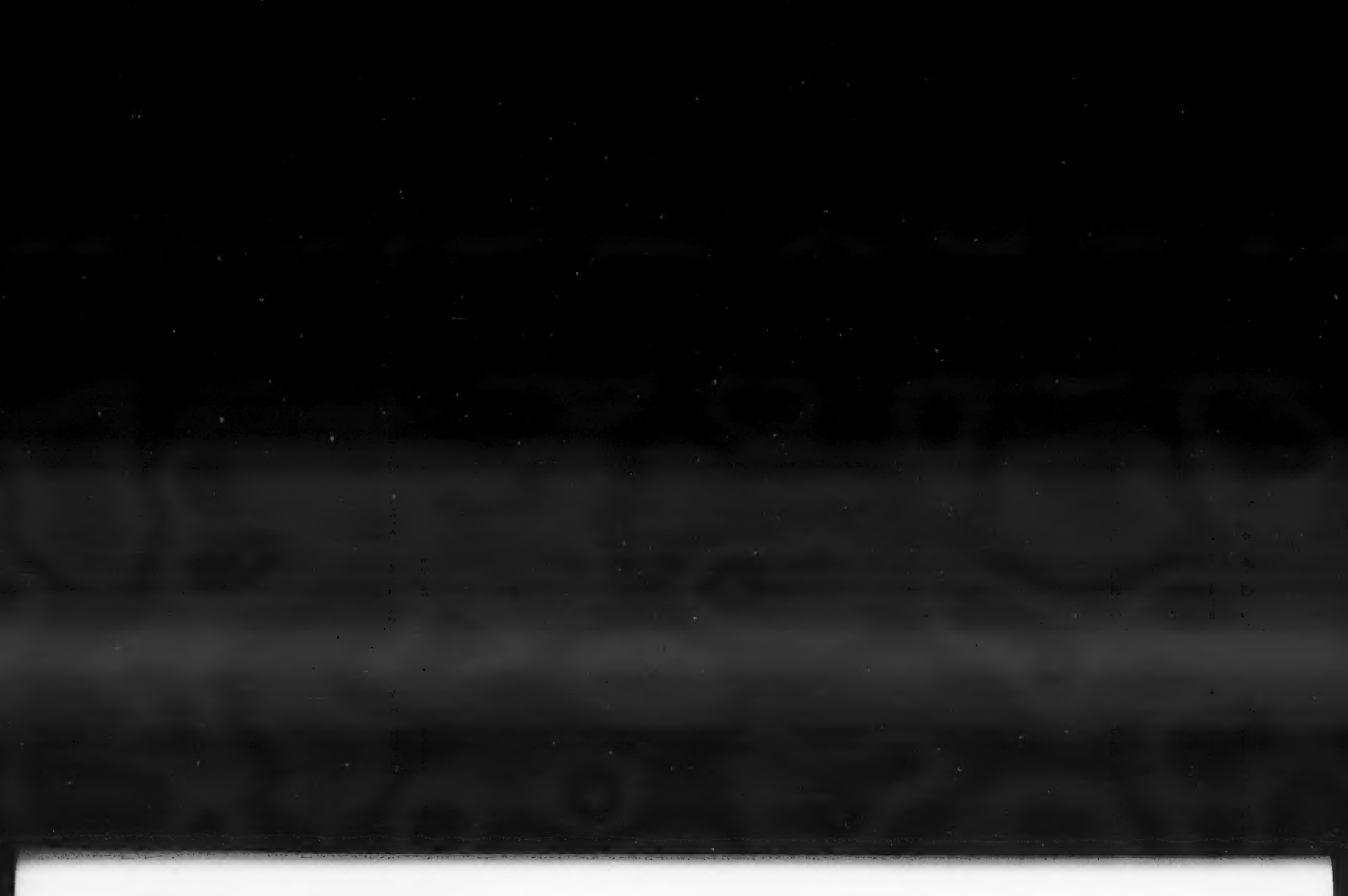
Mr. H. C. Woods, who died on January 4, was well known for his studies in the politics of the Near East. Educated at Harrow and Sandhurst, he served for some years in the Grenadier Guards. From 1908 onwards he travelled extensively in the Balkans and Asia Minor, acting as special correspondent for several newspapers. His publications include 'The danger zone of Europe,' an examination of the problems arising from the Young Turk revolution of 1908, and 'The cradle of the war,' based upon a series of lectures given before the Lowell Institute at Boston during the winter of 1917–18. He had been a Fellow of the Society since 1905, and had lectured to it on the Baghdad railway and on communications in the Balkans.

## MEETINGS: SESSION 1938–39

Fifth Evening Meeting, 9 January 1939. Professor Kenneth Mason, Vice-President, in the Chair

*Elections:* Brigadier-General Sir Joseph Byrne, G.C.M.G., K.B.E., C.B.; Professor Paul Hibbert Clyde; Kenneth Malcolm Edwin Elloy; William W. Forsyth; Richard Gatty; Colin M. Gilray, M.C., M.A.; Joseph Newell Jennings; Miss Gladys Amy Longman, B.A.; Arthur Hollier Payne, M.A.; Alexander Kerr Pringle, B.SC.; Brigadier Hubert Clementi-Smith, D.S.O.; Miss Irene Smith; Kenneth Charles Clyde Tiller; Miss Gertrude Mary Wood

*Paper:* The Antarctic voyages of *Discovery II* and *William Scoresby*, 1935–37. By Dr. G. E. R. Deacon

Third Afternoon Meeting, 16 January 1939. Sir Charles Arden-Close in the Chair

Discussion on the Final Report of the Departmental Committee on the Ordnance Survey. Opened by Brigadier M. N. MacLeod